327

Integrated management of coastal zones

ISSN 0429-9345

FAO
FISHERIES
TECHNICAL
PAPER

327

FAO
fish.
tech.
pap.
no. 327

FOOD
AND
AGRICULTURE
ORGANIZATION
OF THE
UNITED NATIONS

Digitized by the Internet Archive
in 2025

https://archive.org/details/fao-fisheries-and-aquaculture-technical-paper_1992_327

Integrated management of coastal zones

by
John R. Clark
Senior Research Associate
National Park Service Program
Rosenstiel School of Marine Sciences
University of Miami
Miami, Florida, USA

LIBRARY
MAR 08 1994
National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii

FAO
fish.
tech
pap
no. 327

Library
NOAA, National Marine Fisheries Service
SWFC Honolulu Laboratory F/SWC2
2570 Dole Street
Honolulu, HI 96822-2396

FAO
FISHERIES
TECHNICAL
PAPER
327

FOOD
AND
AGRICULTURE
ORGANIZATION
OF THE
UNITED NATIONS
Rome, 1992

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

M-43
ISBN 92-5-103275-0

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying or otherwise, without the prior permission of the copyright owner. Applications for such permission, with a statement of the purpose and extent of the reproduction, should be addressed to the Director, Publications Division, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00100 Rome, Italy.

© FAO 1992

PREPARATION OF THIS DOCUMENT

This document follows the FAO publication "Development of Coastal Areas and Enclosed Seas", which forms part of the report of the United Nations Conference on Environment and Development (UNCED) on "Protection of the oceans and all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resources".

The original version was prepared by FAO in close collaboration with the UNCED Secretariat and all members of the Working Party on Oceans, and with the assistance of the author of this report. It responded to Decision 1/20 of the First Preparatory Committee of UNCED, most specifically items (m) and (q) of paragraph 1 of the Decision related to the following:

- Integrated management for the development of coastal areas and maritime zones under national jurisdiction, providing an appropriate balance between environmental and developmental requirements and, to this end, development of integrated management techniques, including environmental impact assessment.

- Means of protecting or rehabilitating living marine resources and their habitats, including mangroves and coral reefs, taking into account the ongoing work of the United Nations Environment Programme towards a legal instrument on biological diversity and that of its Regional Seas Programme.

It should be noted that the discussions of individual habitat types in Section 3 are partially excerpts from the book "Coastal Resources Management Guidelines", by S.C. Snedaker and C.B. Getter which was prepared by the National Park Service for the US Agency for International Development.

This paper was prepared as a reference source and is not intended as a reader or a narrative text. The material is not necessarily sequential and repetition of certain key matters is intentional, in the interest of making the information most readily usable.

Distribution:

FAO Fisheries Department
FAO Regional Fisheries Officers
Directors of Fisheries
Regional and International Fisheries Organizations
UNEP

Clark, J.R.
Integrated management of coastal zones.
FAO Fisheries Technical Paper. No. 327. Rome, FAO. 1992. 167p.

ABSTRACT

This report identifies governmental actions that can lead to effective management of coastal resources and strengthening the national capacity for effective coastal resources management through Integrated Coastal Zone Management (ICZM). This is a system for controlling development and other human activities that affect the condition of economic resources and the quality of environment in coastal zones.

The overall objective of ICZM is to provide for sustainable use of coastal natural resources and for maintenance of biodiversity. Environmentally planned development is reputed to add to economic and social prosperity of a coastal community in the long term. The orientation of the report is toward developing countries, particularly those of the coastal tropics. Fisheries productivity, increased tourism revenues, sustained mangrove forestry, and security from natural hazard devastation are among the practical benefits of ICZM.

ICZM incorporates modern principles of planning and resources management, intensive information bases an interdisciplinary processes. A major objective is to facilitate the interactions of different coastal economic sectors (e.g., shipping, agriculture, fisheries) toward optimal socio-economic outcomes, including resolution of conflicts between sectors.

ICZM may be initiated in response to a planning mandate but more often because of a crisis - a use conflict, a severe decline in a resource, or a devastating experience with natural hazards.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the assistance and encouragement of the staff of the FAO Fishery Resources and Environment Division, particularly Drs Serge Garcia, John Caddy, and Purwito Martosubroto. Other FAO staff reviewers to whom I am grateful include Messrs H. Cirelli, M. Mekouar, P. Vantomme and A.D. Insull. The generosity of Drs Peter Burbridge and Chua Thia-Eng in critically reading the manuscript is greatly appreciated. Dr Jens Sorensen provided key materials and ideas. Mr Robert C. Milne of the US National Park Service supported much of the earlier work which brought the subject to the present status. Final manuscript preparation was skilfully handled by Messrs Shelly Cooper and Edgar Piehl.

TABLE OF CONTENTS

		Page
1.	**INTRODUCTION**	1
2.	**OVERVIEW**	5
2.1	Driving Forces	5
2.2	The Need for Integrated Management	6
2.3	Benefits of ICZM	6
2.4	Land-Sea Interactions	7
2.5	Goals and Objectives of the ICZM Programme	7
2.6	Scope of the ICZM Programme	8
2.7	Extent of Jurisdiction	9
2.8	Distinguishing ICZM	10
2.9	Boundaries of the Coastal Zone	11
2.10	Sustainability	13
2.11	Creating Protected Areas	14
3.	**COASTAL NATURAL RESOURCE SYSTEMS**	15
3.1	Critical Habitat Resources	15
3.1.1	Mangrove Wetlands and other Intertidal Systems	15
3.1.2	Seagrass Systems	17
3.1.3	Coral Reef Systems	18
3.1.4	Sandy Beach Systems	20
3.1.5	Other Habitats	22
3.1.6	Lagoon and Estuary Systems	22
3.1.7	Critical Habitat Management Issues	24
3.2	Ecological Issues and Resources	26
3.2.1	Non-Sustainable Development	26
3.2.2	Pollution	27
3.2.3	Threats to Biological Diversity	29
3.2.4	Natural Effects	30
3.2.5	Fisheries	30
3.2.6	Ecosystem Level Conservation	31

4. MULTIPLE USES OF THE COASTAL ZONE 32

4.1 Urban Settlement 32
4.2 Industrial Development 34
4.3 Waste Disposal 34
4.4 Shore Protection Works 35
4.5 Ports and Marine Transportation 36
4.6 Land Transportation Infrastructure 37
4.7 Water Control and Supply Projects 37
4.8 Sea Fisheries 37
4.9 Aquaculture 38
4.10 Coastal Forest Industries 38
4.11 Coastal Agriculture 39
4.12 Extractive Industries 42
4.13 Tourism, Recreation and Carrying Capacity 42
4.14 National Security 46
4.15 Lagoons and Estuaries 46

5. PRINCIPLES AND PREMISES 48

5.1 Principle 1: The coastal area is a unique resource system which requires special management and planning approaches 48
5.2 Principle 2: Water is the major integrating force in coastal resource systems 49
5.3 Principle 3: It is essential that land and sea uses be planned and managed in combination 50
5.4 Principle 4: The edge of the sea is the focal point of coastal management programmes 51
5.5 Principle 5: Coastal management boundaries should be issue-based and adaptive 51
5.6 Principle 6: A major emphasis of coastal resources management is to conserve common property resources 53
5.7 Principle 7: Prevention of damage from natural hazards and conservation of natural resources should be combined in ICZM programmes 54
5.8 Principle 8: All levels of government within a country must be involved in coastal management and planning 55
5.9 Principle 9: The nature-synchronous approach to development is especially appropriate for the coast 57
5.10 Principle 10: Special forms of economic and social benefit evaluation and public participation are used in coastal management programmes 58
5.11 Principle 11: Conservation for sustainable use is a major goal of coastal resources management 60
5.12 Principle 12: Multiple-use management is appropriate for most coastal resource systems 62
5.13 Principle 13. Multiple-sector involvement is essential to sustainable use of coastal resources 64

5.14 Principle 14: Traditional resource management should be respected 65
5.15 Principle 15: The environmental impact assessment approach is essential to effective coastal management 66

6. STRATEGIC PLANNING 67

6.1 The Challenge 67
6.2 The Role of Strategic Planning 68
6.3 Strategic Planning as the Second Programme Stage 68
6.4 Policy Formulation 70
6.5 Preparing the Policy Statement 73
6.6 The Strategic Planning Process 74
6.7 Institutions and Jurisdiction 78
6.8 Boundaries 79
6.9 Planning the Form of the Programme 80
6.10 Use of the Strategic Plan 81
6.11 Gaining Support for ICZM 84
6.12 The No-Programme Option 85
6.13 Priority Subjects for Strategic Planning 87

6.13.1 Issues Analysis 87
6.13.2 Project Review 88
6.13.3 Economic Impacts 88
6.13.4 Alternative Livelihoods 90
6.13.5 Critical Areas, Species and Protected Areas 93
6.13.6 Hazard Prevention 94
6.13.7 Pollution 96
6.13.8 Traditional Fishing Rights and Conservation 96
6.13.9 Public Consultation 96
6.13.10 Coordination 97

6.14 Information Needs and Services 97
6.15 The Incremental Approach 99
6.16 International Aspects 100

7. PROGRAMME DEVELOPMENT 102

7.1 Programme Scope 102
7.2 The Problem Solving Approach 103
7.3 Opportunities and Obstacles 103
7.4 Institutional Mechanisms and Inter-Agency Coordination 106
7.5 Training and Public Education 112
7.6 Creating the Master Plan 115
7.7 Continuing Information and Planning Needs 115
7.8 Management Mode 117

7.9 Management Boundaries 117
7.10 Regional Units 122
7.11 Protected Areas 122
7.12 The Special Case of Fisheries and Aquaculture 125
7.13 Traditional Management and ICZM 128
7.14 Research Needs 128
7.15 Mobilization of Financial Resources 130

8. SOME MANAGEMENT MECHANISMS 131

8.1 Pollution Control 131
8.2 Critical Areas 132
8.3 Biodiversity 133
8.4 Protected Areas 134
8.5 Natural Hazards 136
8.6 Restoration 140
8.7 Project Review 140
8.8 Environmental Assessment 142
8.9 Socio-Economic Assessment 142
8.10 Conflict Resolution 142

9. INFORMATION, TRAINING AND EDUCATION 145

9.1 Research and Information 145

9.1.1 Data Base 145
9.1.2 Boundaries 147
9.1.3 Resource Surveys 147
9.1.4 Environmentally Sensitive Areas 147
9.1.5 Carrying Capacity 147
9.1.6 Upland Effects 148
9.1.7 Multiple-Use Management 148
9.1.8 Restoration/Rehabilitation of Resources 151
9.1.9 Environmental Assessment 151

9.2 Training 152
9.3 Raising Public Awareness 152

10. REFERENCES 154

APPENDIX 1

Roster of Integrated Coastal Area Management Programmes, Pilot Programmes and Feasibility Studies 161

1. INTRODUCTION

This report presents basic strategies and methods that can be used to organize natural resources management for coastal zones. It describes the main issues in sustaining the various and valuable economic activities of coastal zones that are based upon living natural resources and suggests ways to organize environmental conservation programmes. Also considered is preservation of coastal biological diversity. Overall, the emphasis is on encouraging development that minimizes negative impacts on living natural resources.

The coastal zone is extremely important to most coastal countries. Consequently, there is concern for its future, particularly regarding the status of its natural resources which provide life support and economic development opportunities to coastal settlements (Figure 1.1, Box 1.1).

In rural areas of the coast, some combination of agriculture, forestry, and fisheries (including aquaculture) is often the major economic activity. In such places, the highest priority should go to conservation of resources to ensure that the combination of resource uses is sustainable.

In coastal zone management, the enclosed seas - e.g., the Black Sea, Red Sea, Chesapeake Bay - are often given high priority if they have concentrations of industry and settlements (as most do) or if they are particularly susceptible to pollution, being shallow and confined (as most are). But the principles of joint land/water management are the same for enclosed seas as they are for more open coasts. Of course, the management agendas and plan priorities change from place to place to meet local circumstances.

The emphasis of the report is on potential governmental actions that can lead to effective resources management. These actions may include both prevention and remedial measures. For both there should be enforceable guidelines to strengthen the national capacity for effective coastal zone management. The approach recommended here is the Integrated Coastal Zone Management (ICZM) system. This is a system for controlling development and other human activities that affect the condition of economic resources and the quality of environment in coastal zones.

Certainly, enough is known of coastal seas ecological processes and resource values, and also of human impacts, to enable governments to start ICZM programmes now to sustain the functional integrity of coastal resource systems that generate natural goods and services for human welfare. A first step would be to establish interim guidelines for coastal resources management and environmental conservation (Clark et al., 1980) and then improve them through trial and through expanded future research.

It must be recognized that it is becoming increasingly difficult to conserve any one particular resource in the absence of a comprehensive, integrated framework for policy, planning and management such as ICZM. Resources conservation and economic development concerns can and must be combined. Well-planned, conservation-oriented development will add to the economic and social prosperity of a coastal community in the long term. Environmentally destructive development will sooner or later have a negative socio-economic impact.

Figure 1.1 The Coastal Area and Activities that Cause Resource Use Conflicts. Source: Joliffe and Patman (1985)

BOX 1.1 - LEGEND FOR FIGURE 1.1

1) Upstream dam or barrage
2) Power line
3) Lacustrine reclamation
4) National park/country-side conservation
5) Effluent discharge
6) Deforestation
7) Flood-liable area
8) Coastal industry/ power stations
9) Estuarine urbanization
10) Drainage/irrigation
11) Transport links
12) Redundant docks
13) Coastal airport
14) Wetland conservation/ nature reserve
15) Estuarine reclamation
16) Mariculture
17) Fishing harbour
18) Caravan park
19) Coastal settlement
20) Eroding cliff
21) Marina
22) Dune conservation area
23) Inland water body, e.g., flooded gravel pit
24) Hoverport
25) Dredged approach channel
26) Sand banks
27) Multiple water space use
28) Scientific interest
29) Buoys, e.g., water skiing
30) Artificial reef, e.g., fishing
31) Marine breakwaters
32) Artificial beach
33) Hotel/apartment development
34) Groin field
35) Bulk tanker terminal
36) Beach mining
37) Buoys
38) Coastal trade
39) Long-sea outfall
40) Aggregate extraction
41) Artificial island
42) Lighthouse
43) Cross-channel ferries
44) Floating or submerged storage tanks
45) Shipwreck
46) Spoil dumping
47) Offshore navigation
48) Offshore oil/gas rig and undersea pipelines
49) International sea trade
50) Dumping of toxic wastes
51) Military activities, e.g., air-to-sea firing range

Source: Joliffe and Patman (1985)

It should be noted that coastal resources conservation and biodiversity preservation are more often restrained by political uncertainty and bureaucratic inertia than by shortage of scientific information. This situation is gradually improving as governments begin to realize the economic importance of the resources of the coastal zone.

Intertidal areas are especially important parts of the coastal ecosystem, including the mangrove forests, salt marshes, tide flats and beaches. They define the ecological boundary between land and sea and play an important role in coastal productivity as well as in pollutant trapping. But when shoreline development begins, these habitats are often the first to be obliterated by land-filling, seawalls, groins and bulkheads.

The long term success of ICZM depends on the support of those groups and individuals whose interests will be most affected by the implementation of the programme. Participation by major ICZM stakeholders, including the general public, is needed to involve all interests in the processes of programme formulation and implementation.

The orientation of this report is towards the developing coastal countries, particularly those of the tropics (see Appendix 1 for a roster of countries involved with ICZM). Nevertheless, most of the ideas and the material to be found here are based on principles and guidelines of wide application which should also serve developed countries and those in temperate zones.

2. OVERVIEW

If coastal resource systems are to remain productive, their management requires a holistic and comprehensive approach. It may be necessary to define a broad management zone - one extending from the coastal hinterlands and lowlands (the "dry side") to the coastal waters and the deep sea (the "wet side"); and a multi-sector management programme must be devised so that all stakeholders and all affected government agencies are involved. Another imperative is broad public support.

The subject of this report, Integrated Coastal Zone Management (ICZM), is a planning and coordinating process which deals with development management and coastal resources and which is focused on the land/water interface. Many countries are now organizing ICZM programmes but only a few (e.g., the USA, Sri Lanka) have had programmes in full operation. Other countries have moved in the direction of comprehensive ICZM programmes or have organized partial ICZM programmes (e.g., Philippines, Australia, Costa Rica).

The ICZM process is explained by Chua Thia-Eng as follows (pers. comm.): "ICZM provides the opportunity to allow policy orientation and development of management strategies to address the issue of resource use conflicts and to control the impacts of human intervention on the environment. It provides institutional and legal framework, focuses on environmental planning and management, coordinates various concerned agencies to work together towards a common objective. Sectoral planning and management is still [essential but should] operate within the general framework of ICZM. Maintaining species habitats, natural resource base and management of development processes are part of ICZM programme".

2.1 Driving Forces

Behind the devastating coastal resources depletion that many countries are suffering are several major driving forces, including some areas of misunderstanding. Examples of these forces are listed below (paraphrased from Chua and White, 1988):

- High rates of population growth;
- Poverty exacerbated by dwindling resources, degraded fisheries habitats and lack of alternative livelihoods;
- Large-scale, quick-profit, commercial enterprises which degrade resources and conflict with interests of the local people;
- Lack of awareness about management for resource sustainability among local people and policy-makers;
- Lack of understanding of the economic contribution of coastal resources to society;

- Lack of serious government follow-up in support and enforcement of conservation programmes.

Until such forces are offset, there is little hope to accomplish environmental conservation, or resource sustainability.

Programme initiation for ICZM is usually in response to a perceived use conflict, a severe decline in a resource, or a devastating experience with natural hazards. Launching a coastal programme demands strong motivation. Such motivation can arise from events that dramatize the importance and vulnerability of coastal resources. The potential long-term socio-economic benefits of coastal management must be evident in order for environmental quality and natural area protection to enjoy continued support. Fisheries productivity, increased tourism revenues, sustained mangrove forestry, and security from natural hazard devastation appear to be the four most common and persuasive arguments for ICZM (Sorensen and McCreary, 1990).

2.2 The Need for Integrated Management

Clearly, it is becoming more and more difficult to manage any one particular coastal natural resource or enhance one economic sector in the absence of a comprehensive, integrated, framework for policy planning and management. The overall objective of an integrated management programme, like ICZM, is to provide for the best long-term and sustainable use of coastal natural resources and for perpetual maintenance of the most beneficial natural environment.

ICZM incorporates modern principles of planning and resources management, intensive information bases and interdisciplinary processes. It has proved to be an effective general framework for dealing with conflicts arising from interactions of the various uses of coastal areas. It aims at coordinated development and resources management.

For ICZM to succeed, a broad context of government and interest group involvement is essential. Fishing, mining, shipping, defence, public health, and recreation are complex activities requiring cooperative management and intersectoral coordination. To accomplish the coordination requires the full involvement of all the various stakeholders through an ICZM comprehensive and integrated programme.

For many countries, there is an urgency about adopting a systematic programme to conserve coastal resources. As a result of world population growth and migrations, six out of ten people now live within 60 km of the coast and the population of the coastal zone is projected to double within the next 20 to 30 years. Also, global environmental change (e.g., sea level rise) may have its biggest impact on coastal areas (IUCN, 1990).

2.3 Benefits of ICZM

ICZM programmes can: 1) minimize costly delays in project implementation; 2) minimize damage to the marine environment and its resources; 3) minimize losses to the various users (from resource depletion, access limitations, etc.); and 4) make the most efficient use of infrastructure, information and technology available to marine development sectors.

As examples, ICZM can benefit a country or region through any or all of the following:

1. Facilitating sustainable economic growth based on natural resources

2. Conserving natural habitats and species

3. Controlling pollution and the alteration of shorelands and beachfronts

4. Controlling watershed activities that adversely effect coastal zones

5. Controlling excavation, mining and other alteration of coral reefs, water basins, and sea floors

6. Rehabilitating degraded resources

7. Providing a mechanism and tools for rational resource allocation

All these require coordinated actions for their accomplishment, a need that ICZM can fulfil.

2.4 Land-Sea Interactions

A major value of integrated coastal zone management is that it addresses the land and the sea simultaneously. Linkages between "dryside" (land) and "wetside" (sea) of the coast, then, preclude sustainable development of coastal/marine resources without coordinated management.

It is basic to coastal management to recognize how strongly activities on land affect the condition of the sea. The sea is impacted by distant events that occur far inland - river discharges, banana plantations, deforestation - all may affect coastal ecosystems.

Conversely, the sea strongly affects the land and intertidal areas; for example, pollution from tanker bilge washings or property destruction from cyclonic storm flooding and wave action. The countering "natural defences" of the coastline - beaches, mangroves and coral reefs - can be extremely important for protecting shorelines and coastal villages against storm waves and shore erosion.

2.5 Goals and Objectives of the ICZM Programme

The overall goal of the ICZM-type programme is to ensure optimum sustainable use of coastal natural resources, perpetual maintenance of high levels of biodiversity, and real conservation of critical habitats. Tangible objectives of ICZM include, for example, supporting fisheries, protecting the community from storm ravages, attracting tourists, promoting public health, maintaining yields from mangrove forests, preserving coral reefs. All these require coordinated community action for their accomplishment, a need that ICZM fulfils.

A major objective of ICZM is to coordinate the initiatives of the various coastal economic sectors (e.g., shipping, agriculture, fisheries) toward long-term optimal socio-

economic outcomes, including resolution of conflicts between sectors and arranging beneficial trade-offs. Integrated in this way, a multi-sector approach could jointly guide the activities of the key economic sectors under an effective coastal planning and management system.

As an example of the above, both coastal tourism and fisheries depend to a large extent on a high level of environmental quality, including coastal water quality. Both sectors may be impacted by "spillover" effects such as pollution, loss of wildlife habitat and aesthetic degradation from uncontrolled oil and gas development. Therefore, these different sectors should be working through ICZM to extract safeguards from the oil industry.

In another example, fisheries may require port services similar to those which tourism depends on as well as an infrastructure system that supplies water, sanitation, transportation, and telecommunications. Therefore, plans for both tourism and fisheries should be integrated with those for transportation and public works through ICZM.

Resources management and environmental conservation, which provide the motivation for ICZM planning and management programmes, are not incompatible with economic growth. In fact, enhanced long-term economic development may be the overall driving force of ICZM. Its advocates must ensure that ICZM is not perceived to have only negative impacts on jobs, revenue, or foreign exchange. If this were the case, the programme would not be likely to survive even the initial planning stages.

2.6 Scope of the ICZM Programme

ICZM refers to a special type of governmental programme established for the purpose of conserving coastal resources or environments (Sorensen and McCreary, 1990) through control of development. Use of the term implies that the governmental unit administering the programme has distinguished a special coastal zone as a geographic area combining both ocean and terrestrial domains.

A coastal programme includes several types of resources and environments as well as the interests of the various economic sectors that are stakeholders in coastal resources. This latter aspect - the involvement of all parties of interest - is what distinguishes "Integrated Coastal Zone Management". The sectors may include shipping, housing, manufacturing, fisheries, agriculture, electric power, transport, nature conservation, or tourism.

To accomplish its purposes, ICZM requires several national actions, including the following:

1. A policy commitment to support coastal resources management and environmental conservation

2. Achieving an understanding on resources and environmental objectives among the various coastal stakeholders

3. Establishment of a governmental office for coordination of coastal affairs

4. Initiation of a system for review of development projects, including environmental assessment

5. Accumulation of technical information

6. Design and development of effective planning and management programmes

The degree to which the above are accomplished governs both the level of ICZM programme integration (collaboration among numerous government and private economic sectors) and comprehensiveness (the scope of development control and resource management objectives) that can be achieved. High levels of both can be achieved in a full-scale ICZM programme, the fundamentals of which are addressed later in this report.

Where the above tableau appears too complex or daunting, the ICZM programme can be simplified. A simple ICZM programme needs to include only the following components:

1. Arrangements: Policy, goals, legal authorization and an enforcement mechanism

2. Coordination: A coordination office

3. Review: A project review/permit mechanism and environmental impact assessment procedure

To be successful, ICZM has to be a distinct process focusing on distinct issues. Its goals must be clear and unambiguous.

2.7 Extent of Jurisdiction

The ICZM programme is expected to focus most sharply on management of the physical development process using planning procedures and government regulations. Resource management will usually have been mandated to other agencies even before the ICZM programme is implemented. Because these mandates are not easily changed, management of fisheries and mangrove forest harvests will usually remain with existing resource agencies. Parks and reserves also may continue to be managed by the existing jurisdiction. Also pollution control may remain with the national agency responsible for environmental protection.

ICZM should be seen as a multi-sectoral process created to improve development planning and resource conservation though integration and cooperation. It should not be seen as a substitute for uni-sectoral programmes such as tourism or maritime administration, nor as a substitute for coastal forestry or agriculture programmes.

Regarding fisheries, while ICZM programmes can help protect fish habitat, nursery areas, and water quality in fishery areas, they do not usually address fisheries operations such as controls on harvesting (e.g., quotas, sizes, closed seasons, gear type, etc.). Because these control functions typically involve only the fishery sector, they can be handled separately. As mentioned, ICZM usually addresses multi-sector concerns. However, the ICZM format can assist fisheries harvest management and such controls as closed areas and maintenance of traditional fishing practices. ICZM can support fisheries management particularly in "developing countries beset with overfishing problems and multiple resource use conflicts" (Chua Thia-Eng, pers. comm.).

Most of the management strategies discussed in this report require direct action of governments - regulatory actions or designation of coastal land or water areas as nature reserves or managed multiple-use areas. The ICZM literature gives very little information about market-based incentives to the private sector such as: allocations, charging of user fees, tax incentives, and establishment of exclusive rights to resources (property rights). In the future, such approaches will probably be more prominent.

Because of the nature of the coastal zone and of enclosed seas resources and geographic circumstances, many of the main issues facing countries are of international scope. These problems may include sea transport, shared fisheries, cross-border pollution transport, multi-country endangered species.

Development projects are often financed by external sources. The major providers of investment capital to developing countries - World Bank, USAID, Inter-American Development Bank, Asia Development Bank, etc. - are slowly but surely taking the lead in a movement toward environmental responsibility.

2.8 Distinguishing ICZM

The natural resources of coastal areas are so different from their terrestrial counterparts as to require different and special forms of management. For example, coral reefs, beaches, coastal lagoons, submerged seagrass meadows, and intertidal mangrove forests have no counterparts in terrestrial resources. Threats to the productivity of these unique resource systems arise from development activities and their-side effects, such as reef and beach mining, shoreline filling, marine construction, lagoon pollution, sedimentation, and other activities that are distinct from those on land. Therefore, a special and distinct management methodology is required, such as ICZM.

ICZM is interdisciplinary. It considers, coordinates, and integrates the interests of all appropriate economic sectors (Caddy, 1990). It is needed in order to cope with special conditions of coastal resource conservation and economic development. It is particularly useful in solving problems that exist between the various sectors; for example, in resolving conflicts among fisheries, tourism, oil and gas development, and public works where these sectors are all attempting to use the coastal zone simultaneously (Sorensen and McCreary, 1990).

The above needs are accomplished by managing the coastal area as a unit and by integrating the management process with all appropriate economic sectors (shipping, mining, housing, transportation, etc.). An integrated coastal zone management programme must address coastal waters and shorelands together in a single, unified programme. The programme must recognize coastal shorelands, lowlands, intertidal areas, lagoons, and open waters as a single interacting and indivisible resource unit that lies between the hinterlands and the open sea and whose future must be planned and managed as a unified whole.

This becomes a complicated undertaking because so many interests have a stake in how coastal resources are allocated (see Figure 2.1). One potential simplification is zoning of the coastal area for advance geographic designation of permitted uses.

Development planners, particularly, must recognize that modification of the hinterlands has a high potential for adverse effects on resources of coastal zones, including enclosed seas (Clark, in press). Examples of major impacts are: land clearing and grading, agricultural pollution (runoff); siltation from eroded uplands; dams across major rivers; land filling to provide real estate for industry, housing, recreation, airports, and farmland; harbour improvement; mining/quarrying; and excessive cutting of mangroves for fuel.

Another distinguishing facet of ICZM is that it combines development management with resources management. General environmental conservation is a fundamental component. It includes some very important, but not so tangible objectives, such as nature protection and biodiversity conservation. The extent to which such environmental and bio-diversity conservation objectives should be included in any ICZM programme depends on the particular country's willingness to extend to nature the priorities usually given to economic yields, products, employment, income, and consumption. Recently, the nature motivation has been enhanced by the recent global awakening to the need for ecological conservation.

2.9 Boundaries of the Coastal Zone

The coastal area is the interface between the land and the sea and may extend inland and seaward to a variable extent, depending upon the objectives and needs of the particular programme. By virtually any set of criteria, the coastal zone is a linear band of land and water that straddles the coast - a "corridor" in planning parlance - which has a one-dimensional aspect. The second dimension (width from onshore to offshore) tends to be overshadowed by the linearity; thus people talk about being at the coast or on the coast, but never in the coast.

The boundaries of the coastal zone depend on political, administrative, legal, ecological and pragmatic considerations because there is a broad array of possible coastal issues and because the zone can be affected by remote activities. A narrow coastal zone could be appropriate if its purpose were to manage only the shoreline and intertidal areas. If watershed issues are of concern, then an inland extension is necessary. Likewise, if the issues extend far seaward, then the Exclusive Economic Zone (EEZ) might be included. In the case of small island countries, the whole country might be defined as coastal zone.

From a strategic and political perspective, success in creating a national ICZM-type programme may come more easily if the zone for management is narrow than if it is wide. A mandate to manage a narrow strip of transitional area, comprised of mostly tidally influenced habitats, may win approval more easily than a broader zone including deeper parts of the sea and higher and drier parts of the shorelands. The zone should include, at least, the coastal lowlands, the intertidal areas, salt marshes, wetlands and beaches, and offshore features such as coral reefs and island habitats.

It is often the coastal common property resources of the "wetside" that are emphasized in ICZM rather than the private property of the "dryside". These resources can be adequately managed by a programme that gives priority to the edge zone.

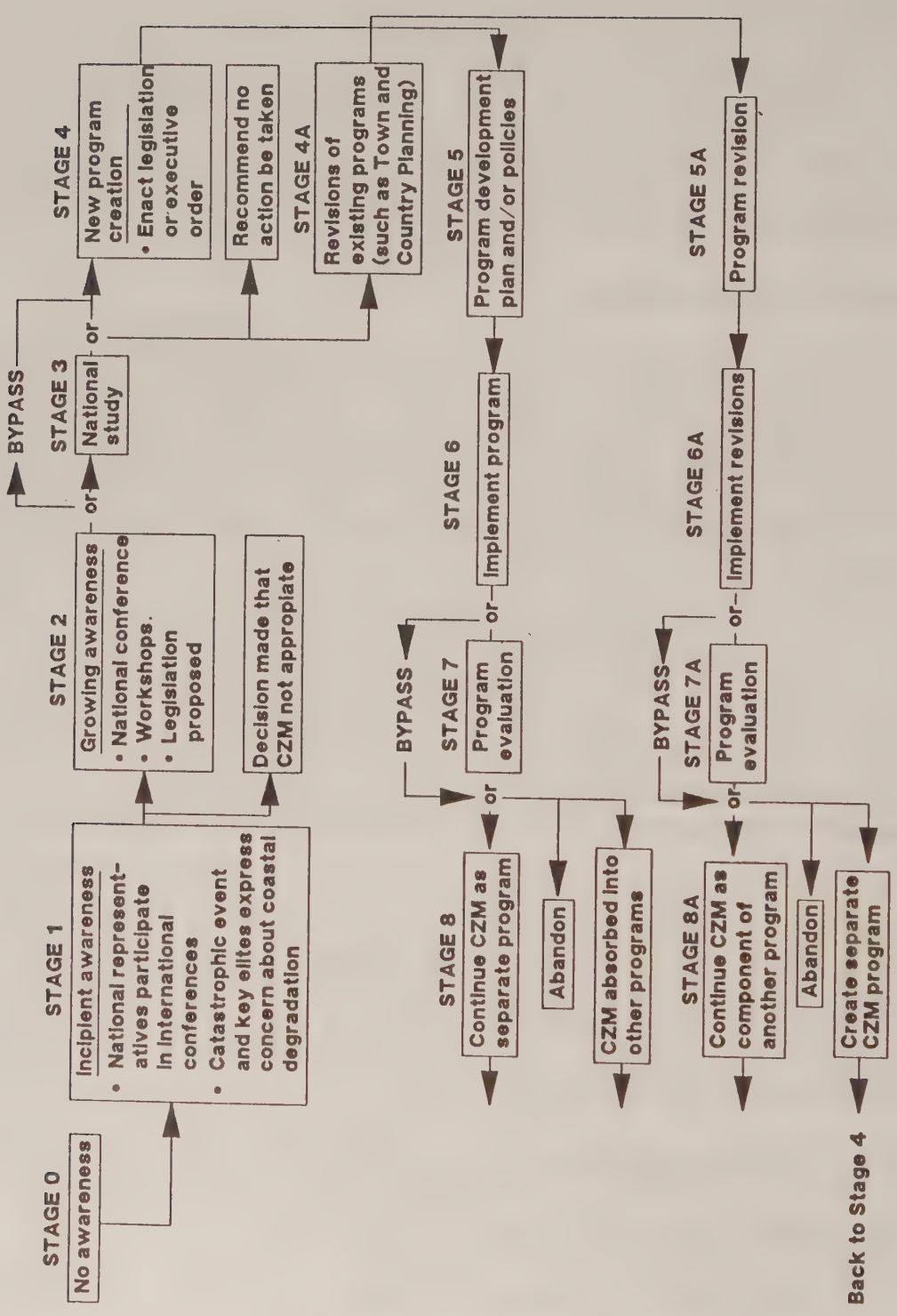


Figure 2.1 Evolution of Coastal Management: From Concept to Practice. Source: Sorensen and McCreary (1990)

2.10 Sustainability

In most parts of the world, renewable coastal resources tend to be economically limited (Snedaker and Getter, 1985). Over time, the demand for a given resource will commonly exceed the supply (unless there is a corresponding increase in price), be it arable land, fresh water, wood or fish. Sustainable use management helps to ensure that renewable resources remain available to future generations in abundance (and at the lowest price).

Sustainable exploitation implies the wise use and careful management (conservation) of individual species and communities, together with the habitats and ecosystems on which they depend, so that their current or potential usefulness to people is not impaired.

Resources should be maintained so that the ability of a resource to renew itself is never jeopardized. Such management maintains biological potential and enhances long-term economic potential of renewable natural marine resources.

The criterion for sustainable use is that the resource not be harvested, extracted or utilized in excess of the amount which can be regenerated. In essence, the resource is seen as a capital investment with an annual yield; it is therefore the yield that is utilized and not the capital investment which is the resource base. By sustaining the resource base, annual yields are assured in perpetuity (Snedaker and Getter, 1985).

Sustainability is the alternative to resource depletion caused by excessive exploitation for short-term profit. An economic corollary is that development projects should be designed to sustain themselves without continued monetary subsidy (from governments, international donors, etc.).

For development and management purposes, the coastal zone is an economic entity, like farmlands, production forests, rangelands or cities. Coastal renewable resources should be managed to produce benefits on a long-term, sustainable, basis. Some fisheries are managed on the principle of "optimum sustained yield" (OSY) but other resources often are not. However, mangrove silviculture in Malaysia is an example of a planned sustainable yield programme.

Exclusive use of a particular coastal resource unit for a single economic purpose is discouraged by ICZM in favour of a balance of multiple uses whereby economic and social benefits are maximized - conservation and development then become compatible goals (if "conservation" is used in its classic sense).

The word "conservation" (in its English language version) came into use early in this century. It was used extensively in the USA by the administration of President Theodore Roosevelt (1901-1908) to mean, simply, "wise use" of natural resources or one might say, "the control of exploitation to ensure resource sustainability". In this classic sense "conservation" and "sustainable use" are nearly analogous.

Unfortunately, in a broader vernacular use, conservation is used interchangeably with such words as "protection" and "preservation"; and "conservationist" is used interchangeably with "environmentalist" or "ecologist". Consequently, using conservation interchangeably with sustainable use could cause confusion. Therefore, (1) the term "resource management"

is used as the agent for achieving sustainable use of resources and (2) "conservation" conjunctively as in environmental conservation (broad) or bio-diversity conservation (narrow).

2.11 Creating Protected Areas

Coastal and marine nature reserves should form a complementary and integral part of ICZM programmes. Such reserves are a necessary component of coastal resource stewardship. While the primary ICZM programme utilizes the regulatory powers of government to achieve resource conservation, by controlling private development activities and resolving potentially divisive conflicts among competing users of the coastal zone, this accomplishes only a part of the job. Additional and more focused natural area conservation (the custodial approach) can be accomplished by exercising the proprietary rights (rights by virtue of ownership) of government through declaration of protected areas - resource reserves, natural areas, and/or national parks.

Protected areas complement and make possible other objectives of ICZM by conserving nursery areas for fisheries production, enhancing tourism revenues and recreational benefits, preserving wilderness values, promoting baseline scientific and management studies, and so forth. At the same time, protected areas gain from the ICZM programme important protection from external impacts. Thus, ICZM and protected areas programmes can be mutually beneficial. Together they ensure the maintenance of a healthy resource base upon which to build sustainable development.

It is also possible for the resource users and private property owners to assist with coastal resources conservation through voluntary actions of their own. ICZM programmes can be organized to encourage private protection of natural areas through provision of incentives.

3. COASTAL NATURAL RESOURCE SYSTEMS

The coastal zone is essential to marine life and supports a large part of the world's living marine resources, certainly more than the open sea. Its wetlands, lagoons, seagrass beds, coral reefs and shallow bays are nursery or feeding areas for most coastal and many oceanic species. This zone has the highest biological diversity of any part of the sea.

While the whole ecosystem is the focus of management, each of its structural parts and essential processes must be conserved - with the emphasis placed on critical areas. For example, the mangrove forests, tideflats, beaches, seagrass or kelp beds, and coral reefs need special attention.

3.1 Critical Habitat Resources

Although ICZM programmes are created primarily to manage physical development, they have to be based upon detailed knowledge of resource vulnerabilities and a candid examination of conservation issues.

In tropical countries - to which this book is oriented - ICZM conservation programmes may be centred on the following "critical habitat" types: mangrove forests, coral reefs, submerged seagrass meadows, beach-dune systems, and lagoons/estuaries (including embayments) known to be especially valuable. With conservation of these five habitats as a priority, it is necessary to understand their vulnerabilities and conservation needs.

While it is useful and practical to focus on individual habitat types, one must not forget that they exist only as components of wider coastal systems; therefore, they should be managed as parts of a greater system (see 3.1.7).

3.1.1 Mangrove, Wetlands and other Intertidal Systems

Some 24 million hectares of mangrove forests occur in coastal areas of subtropical and tropical countries of the world. Mangroves are found along sheltered coastlines where wave activity tends to be minimal. The term mangrove refers to any of dozens of species of trees capable of living in saltwater and salty soil regimes (Figure 3.1).

Ecologically, mangrove communities have a variety of recognized roles in the areas where they occur. A prominent role is the production of leaf litter and detrital matter which is exported to lagoons and the nearshore coastal environment. The organic matter exported from the mangrove habitat is utilized in one form or another by the inhabitants of estuaries/lagoons, near-coast waters, seagrass meadows, and coral reefs which may occur in the area. Most tropical commercial shrimps and many fish species are supported by this food source. Over 30 percent of the fisheries of Peninsular Malaysia (about 200 000 t) are reported to have some association with the mangrove ecosystem.

Mangrove ecosystems also provide a valuable physical habitat for a variety of important coastal species. Waterfowl and shorebirds are well known and highly valued inhabitants of wetlands, as are alligators and muskrats. Less evident, but equally important inhabitants are crabs, shrimp, and the important juvenile stages of commercial and sport fishes, along with numerous forage species of fish and invertebrates (Clark et al., 1980).

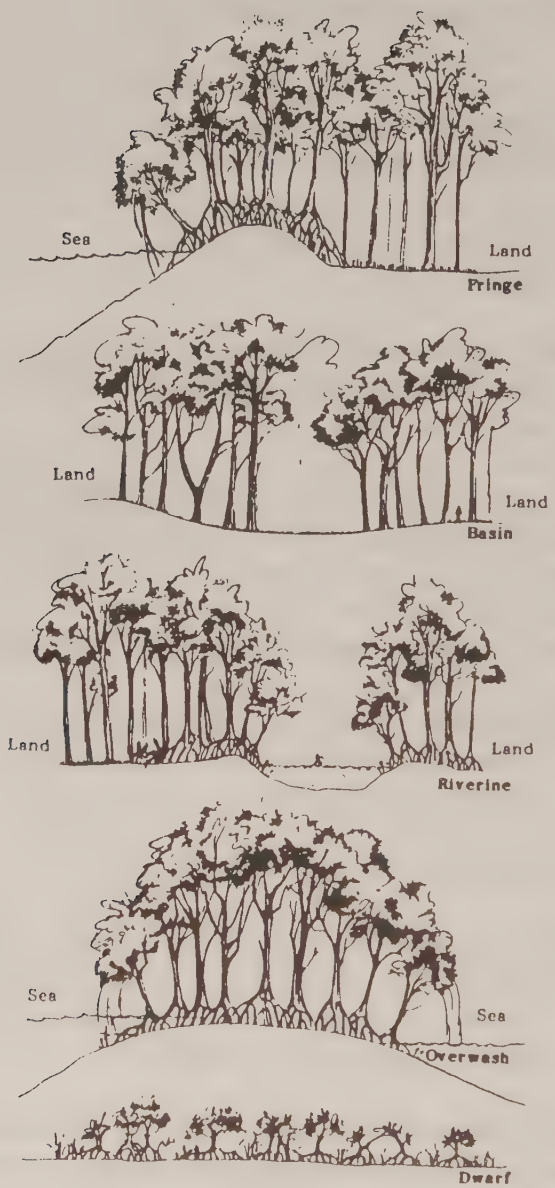


Figure 3.1 *Five Mangrove Forest Structural Types*
Source: Snedaker and Getter (1985)

Shoreline mangroves are recognized as a buffer against storm-tide surges that would otherwise have a more damaging effect on low-lying land areas. Littoral strip mangroves planted by the Bangladesh Government in the 1980s are credited with saving thousands of lives and millions of dollars worth of property during the cyclone of 29 April 1991 that ravaged the southeast coast of the country. Also, mangroves are often noted for their ability to stabilize coastal shorelines that would otherwise be subject to erosion and loss. Conversely, if left in place they can pre-empt development sites that are at too low an elevation and are hazardous real-estate sites.

The value of the mangrove resource in terms of its marketed products can be expressed in economic terms. The "free" services provided by the mangroves are more difficult to measure and consequently are often ignored. These "free" services would cost considerable energy, technology and money to be provided from other sources. Since this is seldom taken into account, the total value of the mangrove resource is usually quite significantly underestimated (Hamilton and Snedaker, 1984).

In general, the mangrove ecosystem is fairly resistant to many kinds of environmental perturbations and stresses. However, mangroves are sensitive to excessive siltation or sedimentation, stagnation, surface-water impoundment, and major oil spills. These actions reduce the uptake of oxygen for respiration which results in rapid mangrove mortality. Salinities high enough to kill mangroves (+90 ppt) result from reductions in the freshwater inflow and alterations in flushing patterns from dams, dredging, and bulkheading. Lowered salinities from seawalls and coastal structures and restriction of tidal flow also kill mangroves. On the other hand, mangrove forests help maintain coastal water quality by extracting chemical pollutants from the water.

A major problem that affects mangrove habitats results from man's desire to convert mangrove areas to residential, commercial, industrial, and agricultural real estate by land filling. In addition, there is an increasing demand for forest wood products that results in the exploitative clear-felling of the forests.

3.1.2 Seagrass Systems

Submerged seagrasses are often abundant in the shallow waters temperate and tropical coastal environments of the world. Seagrass beds, or meadows, are highly productive and valuable resources which enrich the sea and provide shelter and food for some of the most important and valued species of fish and shellfish.

Seagrasses grow best in the quiet, protected waters of healthy estuaries and lagoons, often in beds, or meadows, that are easily delineated for classification as critical habitat areas. They are normally found in shallow areas where light can readily penetrate and enable photosynthesis to occur. Seagrass beds extend shoreward to the point where wave action prevents them from rooting.

High productivity of seagrass habitats is associated with both seagrass growth and the production of "epiphytes" attached to the leaf surfaces. For example, primary productivity (amount of plant production) for two common seagrass species has been shown to be higher per acre than for average corn and rice cultivation in the USA.

Seagrasses intermingle with both mangrove and reef communities at their respective seaward and landward boundaries. Submarine meadows of seagrass frequently provide the link between mangrove and coral reef ecotypes (Figure 3.2). The migration of animals at various life stages from one ecosystem to another for feeding and shelter, coupled with currents that transport both organic and inorganic material from runoff and tidal flushing, ties the offshore coral reefs to nearshore seagrass beds, and the seagrass beds to mangrove estuaries (Berwick and Chamberlain, in press).

Wherever they do occur, seagrass meadows are essential elements of coastal ecosystems. Although seagrasses are little used for commercial purposes, they play an important ecological role, providing a substantial amount of nourishment, nutrients, and habitat. These meadows provide vital places of refuge not found in the open ocean. They attract a diverse and prolific biota and serve as essential nursery areas to some important marine species. Seagrass meadows are also known to trap and bind sediments, thereby reducing particulate pollutants.

Seagrasses are a relatively hardy group of plants, but they are damaged by unfavourable conditions such as excessive siltation, turbidity, water pollution, bottom trawls which scrape and plough the meadows, and marine excavation and filling. Some pollutants in seawater are toxic to seagrasses. Other major threats are dredging and filling operations in seagrass meadows. The disappearance of seagrass communities may go unnoticed because, unlike mangroves and coral reefs, seagrass communities are not visually obvious to most observers.

3.1.3 Coral Reef Systems

Coral reefs occur along shallow, tropical coastlines where the marine waters are clean, clear, and warm. They are one of the most productive ecosystems in the world. The basis for the high productivity of the coral reef ecosystem is a combination of the production of the reef with support from its surrounding environment.

"Fringing" reefs - those contiguous with the shore - are the most common and widespread of the reef structural types; they are most usually found below the low tide level. Their inshore distribution renders them more susceptible to degradation from coastal activities than other reef types. One of the largest fringing-reef formations lies along the Saudi Arabian, 1 100-mile Red Sea coast which is noted for an absence of freshwater (and sediment) runoff (Clark, 1986; Ormond, et al., 1985; Snedaker and Getter, 1985).

"Patch" reefs are isolated and discontinuous bits of coral reef, often lying shoreward of offshore reef structures. "Barrier" reefs are linear, offshore reef structures that run parallel to coastlines and arise from submerged shelf platforms; the water area between the shore and reef is often termed a "lagoon". The world's largest barrier reef system, the Great Barrier Reef, occurs off the Queensland coast of Australia. The areas of greatest coral reef development are the Western Pacific and Indian Oceans and, to a lesser extent, the Caribbean Sea, including Belize and the Bahama Islands.

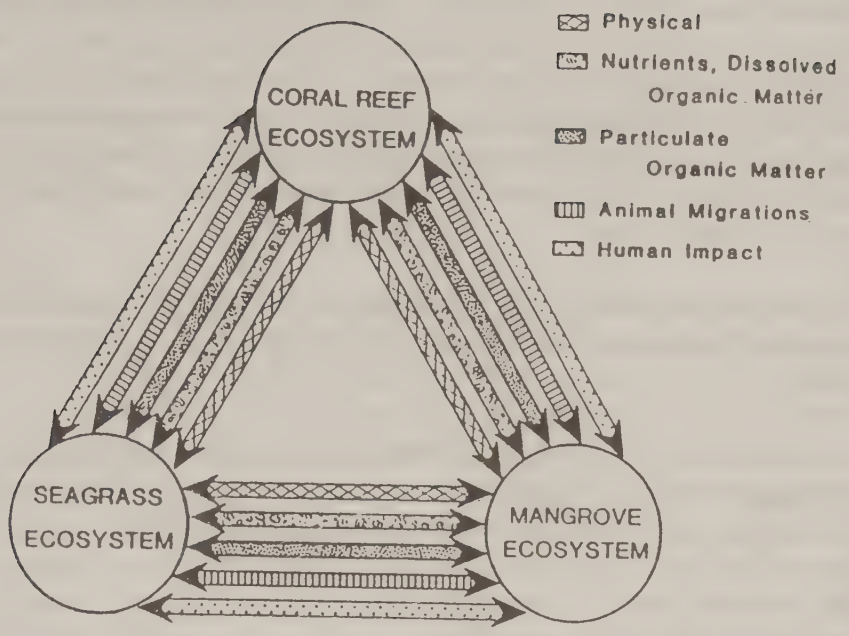


Figure 3.2 Interactions Among Three Major Tropical Habitats of the Coastal Area. Source: Ogden and Gladfelter (1983)

Coral reefs have important economic outputs. For example, they contribute to fisheries of three types: fishing directly on the reef; fishing in shallow coastal waters where coral reefs support food webs, life cycles, and productivity; and fishing in offshore waters where the reef's great productivity may contribute to support of "high seas" fishes. Approximately one third of the world's fish species are said to live on coral reefs (WRI, 1986). Artisanal fisheries dependent on coral reefs have been reported to account for up to 90 percent of the fish production in Indonesia and up to 55 percent of production in the Philippines (providing 54 percent of the protein intake of all Filipinos).

Coral reefs support booming tourist industries in many countries. Catering for snorklers, divers, underwater photographers, sightseers, and fishermen, reef tourism produces thousands of millions of dollars of foreign exchange earnings annually. One reef system alone - Pennekamp State Coral Reef Park (Florida, USA) - attracts 1.5 million visitors per year. More than half of the foreign exchange earnings of the Cayman Islands are from coral reef based tourism. There are now 45 protected coral reef areas (including national parks) in Caribbean countries, but in the absence of broad based ICZM programmes, many have become seriously degraded (ICLARM, 1986).

Coral reefs also serve as natural protective barriers, deterring beach erosion, retarding storm waves, allowing mangroves to prosper, and providing safe landing sites for boats. While Sri Lanka's national ICZM programme is aimed primarily at reducing risks from natural hazards, beach erosion and coastal flooding, a strong component is coral reef protection, necessitating constraints on coral reef mining (Amarasinghe et al., 1983).

Unfortunately, there are numerous destructive forces at work and important coral resources are being degraded at a rapid rate. Some of these forces can be easily controlled through ICZM programmes, but others present serious socio-economic and political problems for many countries. For example, Sri Lanka is faced with finding alternative jobs for thousands of coral miners.

In many countries, reefs are heavily exploited for corals which are harvested for sale as souvenirs or decorations. The market for coral is often quite lucrative and usually export-oriented.

Other damaging activities include the following: 1) siltation and sedimentation created by dredging, filling, and related construction activities and increased soil erosion; 2) pollutants, including spilled oil, industrial wastewater, and domestic sewage; 3) discharge of large volumes of fresh water as may result from diversions and storm-water outfalls; 4) destructive fishing practices, including dynamite; 5) collection of young fishes for sale in the aquarium trade; and 6) tourist visits to reefs which result in breakage from boat anchors and from hand and foot damage.

In addition, there are damages from natural causes such as: 1) outbreaks of reef destroying animals such as crown-of-thorns starfish; 2) diseases like whiteband (which kills elkhorn coral) and blackband (which kills large structural corals); 3) hurricanes that smash the coral and "sandblast" away the living tissue; 4) coral disablement and death from "bleaching" episodes; and 5) die-off or depletion of essential symbionts, such as parrot fish and sea urchins that clean the reef of algae.

Coral reef degradation has serious consequences for tourism, fishing, beach stability and, particularly, for coastal/marine parks. For example, most of the 21 countries and 49 parks (or reserves) in the Caribbean with coral resources have problems (ICLARM, 1986). When serious, coral reef degradation can ruin a park and cut severely into tourism. Some reefs are virtually beyond repair (those closest to settlements) but many that are degraded could still be returned to good or fair condition.

3.1.4 Sandy Beach Systems

Beaches are being lost at a rapid rate through much of the world. No tropical region seems free of risks of erosion. Serious socio-economic situations may arise with erosion and loss of beaches (e.g., risk to property, loss of international tourism revenue). The problem will increase as long as sea level continues to rise - presently from 0.5 to 1 m per century (vertical) in many parts of the world. Beach management is an important element of the ICZM-type programme, and one that should be addressed by experienced professionals.

Beaches are not stable forms; they are dynamic landforms, constantly subject to erosion and/or accretion. The condition of the beach reflects the local balance, or imbalance, between deposition (gain) and erosion (loss). On a worldwide basis, erosion (natural and man-

induced) dominates overdeposition, partly because of the global rise in sea level. Consequently, there is serious loss of beach and beachfront in many parts of the world.

It must be remembered that the key to natural protection, provided by the beachfront, is the sand which is held in storage and yielded to storm waves, thereby dissipating the force of their attack. Consequently, taking sand from any part of the beach - dry beach, wet beach, bar or the nearshore submerged zone - can lead to erosion and recession of the beachfront. Therefore, beach conservation should start with the premise that any removal of sand is adverse, whether for construction fill, concrete aggregate, or any other purpose, and should be prohibited.

Ecologically, the beach is a unique environment occupied by animals that have adapted to the constant motion of the sand, gravel or shell. Many important birds, reptiles, and other animals nest and breed on the berm and open beach, as well as feed and rest there. For example, sea turtles (including such endangered species as the loggerhead and green turtle) come ashore during the spring and summer to lay their eggs in the "dry beach" above the high-water line. Also, terns and other seabirds frequently lay their eggs on the upper beach or in the dunes (Clark et al., 1980).

Beaches provide a unique habitat for burrowing species such as mole crabs, coquina clams, razor clams, and others. There may also be a complex intertidal or subtidal community of crustacean organisms that attract shore birds. The shallow waters of the nearshore zone provide habitat for shellfish of many kinds and a wide variety of forage species, which in turn attract fish and birds (Clark et al., 1980).

Beaches protected by coral reefs are often the best place for dwellings and villages in tropical countries. Beaches are also the source of construction sand in many island countries which can lead to catastrophic loss of beach; (e.g., numerous Caribbean island countries have lost important tourist beaches from sand mining). Many countries are now totally prohibiting sand mining. However, sand could be taken from certain beaches if it could be proved that the mining is sustainable (i.e., if there is a strong source of natural replenishment).

Groins, seawalls, and other forms of protection may have negative secondary effects. These structures, intended to stabilize the beach, may actually deflect and reduce supplies of sand to a level no longer capable of replenishing losses caused by storms - the beach may be lost, even while the structure remains. Often the only solution is "beach nourishment", rebuilding the beach at intervals with sand from elsewhere on land or in the sea. This remedy is so costly that it is not available to most communities.

Since the main threat to the beach is usually from development on the land next to it, beach protection requires coordinated management to include both the beach and the land behind it, including actions to limit construction, require setbacks, prevent excavation, and control beach, harbour, and inlet structures.

The general goal for a management programme should be to maintain the beach by protecting both the natural processes that supply the sand and the sand-storage capacity of the beach. Meeting this goal will require careful examination of conservation needs, natural processes, building practices, and corrective engineering proposals that affect whole beach systems. This process can best be developed through an ICZM programme, as it is in

Barbados. Specific guidelines for beach and dune conservation are given by Snedaker and Getter (1985).

3.1.5 Other Habitats

In addition to mangroves, intertidal areas of the coast include salt marshes and open tide flats. Salt marshes, where they exist, serve many of the same ecological purposes as mangrove forests. They assimilate nutrients and convert them to plant tissue which is broken into fine particles and swept into the coastal waters. In addition the marsh provides a special habitat for many valuable species.

Extensive areas of tide flat (mudflats, sand flats, etc.) are often found in estuaries and lagoons. Such flats are important in processing nutrients for the ecosystem and providing feeding areas for fish at high tide or birds at low tide. Mud flats are often important energy storage elements of the estuarine lagoon ecosystem. The mud flat serves to catch the departing nutrients and hold them until the returning tide can sweep them back into the wetlands. In many estuaries and lagoons,tide flats also produce a high yield of shellfish.

At the higher latitudes there are extensive beds of kelp in certain areas, such as southern California and southwest South Africa. Kelp is a brown alga that roots on the bottom of the sea and extends, via a long stalk, to the surface where its fronds spread over the surface of the sea. Kelp often grows in thick stands, creating a submerged forest that provides an important multiple-species habitat from surface to bottom for sea otters and many other valuable species. These kelp stands are vulnerable to over-harvesting (for alginic acid), species imbalance (too many kelp-eating sea urchins), and pollution.

3.1.6 Lagoon and Estuary Systems

The subject here is coastal embayments - semi-enclosed, sheltered, shallow water bodies that have special characteristics and provide essential natural services. These include such water bodies as lagoons, estuaries, small bays, sounds, fjords, esteros, etc. Many such basins have been converted into harbours, or even large commercial ports. It is to be noted that these embayments are not the "enclosed seas" referred to elsewhere in this report which are large, deep water bodies such as the Black Sea and the Mediterranean.

Estuaries (those supplied by fresh water from rivers) exist, in some form, throughout the tropics except in arid/semi-arid regions (where major rivers are few and discharge is sporadic) and on small islands. Lagoons (limited fresh water supply, high salinity) also exist widely - occupying 10 to 15 percent of the world's coastline. Areas of particularly extensive lagoon/estuarine environment include Brazil, West Africa, the Bay of Bengal shores of India and Bangladesh, and the Atlantic and Gulf of Mexico coasts of the USA.

Both estuaries and lagoons maintain exceptionally high levels of biological productivity and play important ecological roles including: 1) "exporting" nutrients and organic materials to outside waters through tidal circulation; 2) providing habitat for a number of commercially or recreationally valuable fish species; and 3) serving the needs of migratory nearshore and oceanic species which require shallow, protected habitats for breeding and/or sanctuary for their young (nursery areas).

Estuary and lagoon ecosystems play a major role in the life cycles of economically important finfish and shellfish species by providing feeding, breeding, and nursery habitat (Clark, 1977; WRI, 1986). For example, over 90 percent of all fish caught in the Gulf of Mexico are reported to be estuarine dependent to some degree.

These coastal water bodies have sustained human settlements dating back to prehistoric periods. In addition to shipping, modern day lagoons and estuaries serve a multitude of purposes including waste disposal, mariculture, recreation, and residential development (Figure 3.3).

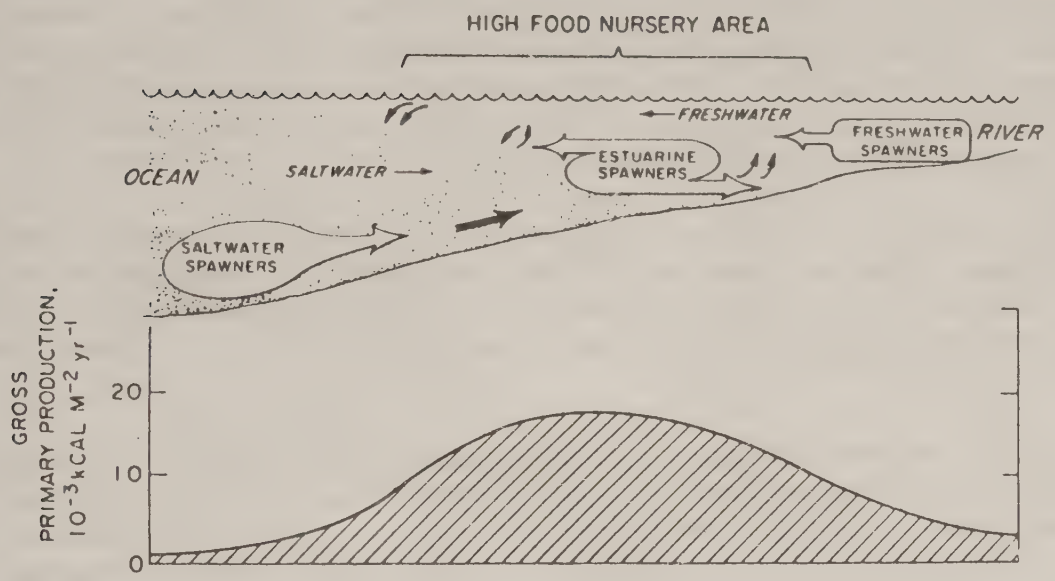


Figure 3.3 *Generic cross-section of a true estuary. Showing that the area of greatest richness occurs between the ocean and the fresh water source where intermediate salinity is found and where small nursery-stage fish and shellfish find optimum survival conditions (richness is measured as gross primary production). Source: UNESC (1987)*

Some large lagoons have been drained and/or filled to create real estate or agricultural land, most notably in land-scarce regions (such as in Japan and in the Netherlands).

The intensive use of embayments that serve as ports and harbours creates a variety of environmental impacts and severe losses of estuarine and lagunal natural resources. Improperly planned development on the shores of estuaries and lagoons creates a variety of short and long term economic losses and opportunity costs resulting from resource collapse. It should be noted that the same management approach may be effective for solving multiple use problems in larger, more open systems like the Bay of Bengal or Gulf of Thailand.

A major source of degradation of shallow embayments is their continued use as pollutant discharge areas. Aside from outright fish kills and other dramatic effects, pollution causes pervasive and continuous degradation, evidenced by the gradual disappearance of fish or shellfish, or a general decline in the natural carrying capacity of the system. The most likely sources of pollution are agricultural and industrial chemicals and organic wastes. Such contaminants in high concentrations create a hostile environment that drives away fish, prevents shellfish from reproducing, or undermines the food chain.

The increased usage of many of these water bodies for transport of oil, chemicals, and other toxic materials - whether by ships, barges, pipelines, or railroads - presents a continuous threat. This pollution is particularly damaging to estuaries and lagoons because their sluggish circulation enables pollutants to reach high concentrations.

Because of the importance of water circulation and flushing in lagoons and estuaries, activities that alter basin configuration can create disturbances with far-reaching effects. Major adverse effects stem from construction of causeways and bridges and from dredging undertaken to create navigation channels, turning basins, harbours and marinas. Other problems arise from laying pipeline or excavating material for fill or construction.

An increasing threat to the well-being of estuaries/lagoons is the impoundment and/or diversion of rivers at upstream locations. When portions of the coastal watershed system are altered or short-circuited, the natural flow pattern is disrupted and estuaries may be subject to surges of fresh water. This not only disturbs the ecosystem, but also increases flood hazards.

The most confined embayments (particularly lagoons) need a maximum of protective controls: protection of wetlands (mangroves, salt marshes) tideflats, and beaches; additional "buffer strips" above wetlands; control of sewage and storm drainage effluents; safeguards against runoff of soils, fertilizers, and biocides from the coastal upland; restrictions on industrial siting; and so forth. The complexity of these problems can best be addressed through an ICZM approach (Figure 3.4).

3.1.7 Critical Habitat Management Issues

While mangrove forests provide life support and income for millions of people, few countries have created effective mangrove conservation programmes. Where laws have been passed, enforcement is often lacking.

The lack of an overall national conservation policy and an ICZM-type programme for the coast weakens the potential for enforcement of laws and regulations. Because mangrove forests are a most important habitat and source of nutrition for fishes, rampant exploitation of the world's remaining 24 million hectares of mangrove forest should be curtailed.

In these situations, the basic habitat and its functions are lost, and that loss is frequently greater than the value of the substituted activity on a long-term basis. In general, these kinds of problems are generated by ignorance of the values of the functioning mangrove system and the absence of integrated planning that takes these functions and values into account.

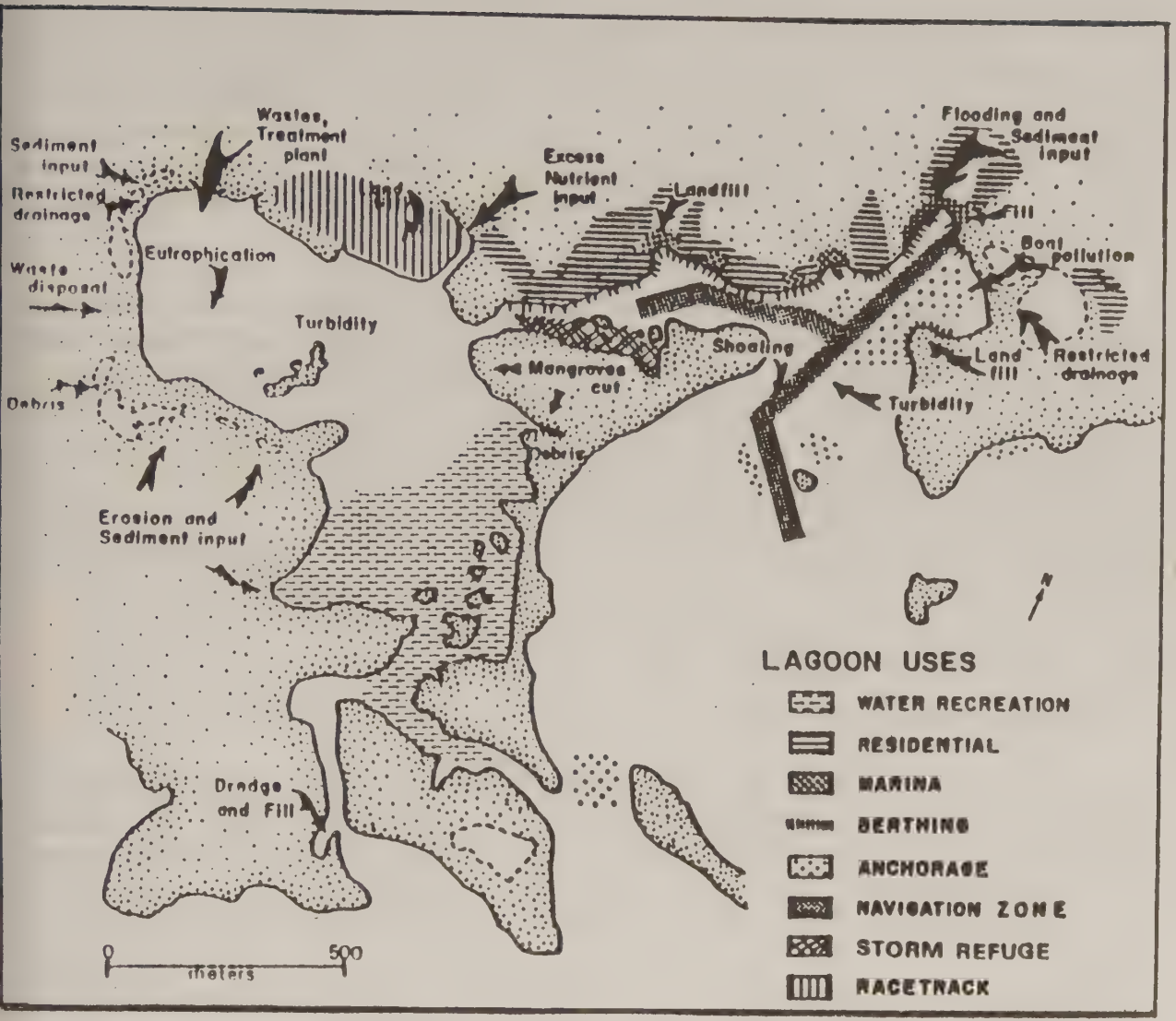


Figure 3.4 *Type of Impacts and Stresses That Could be Addressed in an ICZM Regional Programme - Jersey Bay, Saint Thomas, US Virgin Islands. Source: Towle (1985)*

Seagrass meadows exemplify that much of the damage to marine habitats is not evident. For example, submerged seagrass meadows are a major marine habitat and ecological component of shallow tropical coastal waters, but most people are not conscious of their existence, much less of their important role. Consequently, they are being depleted by widespread dredge and fill activities and by water pollution, including brine disposal from desalination plants and oil production facilities, waste disposal around industrial facilities, accidental spill of petroleum and petroleum products, and thermal discharges from power plants. The loss of seagrasses - an important habitat and source of nutrition - can cause a significant loss in marine life and fisheries production. Because so much of the damage is unseen, it is often overlooked.

Regarding beaches, it should be clearly understood that problems usually result from human actions. Beach and dune systems in their natural state provide a buffer against storm caused erosion and storm breaching. The natural forces at work are immense; therefore, structural solutions to beach erosion and protection of shoreline property from the hazards of sea storms may be expensive and are often temporary or counterproductive. Normally, if nothing is built either on the beach or next to the beach, it will remain as long as the process of natural replenishment continues. Mobile and responsive, the beach will usually remain over the years, but even if sea level or other natural factors cause erosion, problems will not usually emerge unless there are houses or other structures placed near the beach.

3.2 Ecological Issues and Resources

3.2.1 Non-Sustainable Development

The risk of overexploitation of coastal resources is high with consequences such as biological and economic stress, loss of development opportunities, conflict, and reduced seafood security. Basic resources such as fuel, water and fertile land are in short supply and fish stocks are already heavily exploited in many countries. Resources should not be harvested, extracted or utilized on a non-sustainable basis; i.e., in excess of the amount which can be regenerated over the same period. In essence, the resource is seen as a capital investment with an annual yield; it is therefore the yield that should be utilized and not the capital (Clark, 1991c).

Pursuing development on a sustainable basis is recognized as an absolute necessity to sustain progress in health, food security, housing, energy and other critical needs. This requires maximum efficiency in the use of the resources and in the application of capital investments and recurrent inputs. It calls for the full utilization and valuation of the primary products and by-products it contains. Many countries are finding it necessary to give resource conservation and environmental protection high standing in the economic development planning process (Clark, 1991c).

Natural resource depletion, in all sectors of development, is aggravated by users concerned with short-term profits and by the absence or defined user rights (Clark, 1991c). It must be remembered that the coastal sea and transitional areas are a commons. Theoretically owned by all the people, the coastal commons is held in trust by the government and its uses decided by government. Tenure systems are particularly inadequate in the aquatic coastal area and will require strong efforts to establish them explicitly or revive them formally (traditional user rights).

3.2.2 Pollution

One of the most serious indirect impacts of coastal developments is that of a decline in water quality. Polluted effluents are often the most common source of adverse effects on coastal and marine ecosystems (Table 3.1). Some of the more common sources of pollution and their impacts are discussed below (Clark, 1991a,b):

Domestic Sewage: Sewage outfalls (discharge) are troublesome, particularly if inappropriately sited or inadequately treated. Domestic sewage may result in eutrophication by overloading the marine environment with nutrients and may introduce pathogens and toxic matter. The consequences of discharging untreated sewage into the coastal environment includes environmental degradation associated with eutrophication and potential or actual impacts on public health due to sewage mediated pathogens. This is exemplified by the forced closure of a hotel in Costa Rica which was responsible for discharging raw untreated sewage in the nearby Manuel Antonio National Park.

Eutrophication (overfertilization): Caused by excessive nutrients from organic waste (like sewage). In particularly susceptible environments, such as coral reefs, this pollution impact disturbs the delicate balance maintained among a large number of different species, often causing dramatic increases in populations of nuisance species (e.g., algae) at the expense of prized species (e.g., lobster). However, research in Barbados showed that nutrients can be beneficial to coral ecosystems in small amounts but destructive in larger amounts. Other examples of beneficial effects of sewage have been found but techniques for evaluation are not available.

Agricultural Wastes: Agricultural wastes (e.g, manure, fertilizers, pesticides) contribute nutrients in the form of fertilizers as well as toxic compounds from agricultural pesticides. Many of these toxic compounds have a long half-life period, remaining active for many years and as a result penetrate most ecosystems, including even those of "remote areas" such as the Antarctic.

Industrial Wastes: They contain a variety of toxic substances including heavy metals (lead, mercury, cadmium, etc.), radioactive elements, acids and innumerable other toxic industrial chemicals. The most important sources of heavy metals in the tropical marine environment have been cited as the result of mining and dredging operations, smelting processes, offshore oil drilling, desalination plant effluents, thermal power plant, effluent and sewage discharge.

Table 3.1 **Typical Coastal Water Pollutants and Their Effects**
Source: NCDNR (1986)

POLLUTANT	SOURCE	EFFECT ON COASTAL WATERS
Petroleum Hydrocarbons	Fuel exhausts Motor oil and grease Power plant emissions Industrial discharges Spills and dumping Leaking underground storage containers Urban runoff	Spills can kill aquatic life, damage beaches, and permanently destroy wetlands. Runoff can be toxic to marine organisms – causing death, disease and reproductive problems.
Chlorine	Water treatment plants Swimming pool backwash	Kills aquatic life.
Nutrients	Agricultural, forestry, and urban runoff Industrial and boat discharges Sewage treatment and package plants Septic tanks Animal feedlots	Enrichment of rivers and sounds (eutrophication) resulting in algae blooms. Blooms can alter the food chain then decay, depleting oxygen and causing fish kills. Eutrophication is also suspected of causing some fish disease problems.
Fresh Water	Water running off impervious surfaces Land clearing Draining wetlands Channelization of streams	Changes salinity patterns in estuarine habitats, causing slowed growth or death of juvenile organisms, or poor reproduction.
Bacteria and Viruses	Septic tanks that are spaced too densely, placed on porous soils, located in high water tables, or that leak Sewage treatment or package plants Boat discharges Animal feedlots Urban runoff	Contaminates shellfish waters, so consumption of shellfish may cause disease. Contaminate groundwater, so using for drinking or bathing may cause disease. Contaminates surface waters, so swimming may cause disease or wound infections.
Sediment	Land clearing Dredging Erosion	Clogs marine waters. Covers marine habitats, smothering some organisms. Causes turbidity in water, shading out producer organisms and altering the food chain.
Temperature	Factories Electric generating plants Urban runoff	Alters reproduction of fish. Reduces dissolved oxygen which may then cause fish kills. Contaminates fresh water supplies used for drinking, irrigation, and the like.
Heavy Metals	Fuel and exhaust of motorboats and automobiles Industrial emissions and effluent Sewage treatment plant effluent Landfill wastes/leachate Urban runoff Naturally in soil Hazardous waste spills and disposal	Accumulate in fish tissues and are passed on to humans. Contaminate drinking water, causing brain damage, birth defects, miscarriages, and infant deaths.
Synthetic Organic Chemicals	Forestry, urban, and agricultural runoff Industrial and municipal effluent Spills or dumping	Cause cancer, birth defects, and chronic illness when consumed in contaminated water supplies or seafood.

Oil Spills: Accidental spills are becoming increasingly more common as sea traffic increases, facilities are built and the dependence on fossil fuel grows. In small island ecosystems, the impacts can be felt even more as important habitats are much smaller in scale and as such may have an increased vulnerability. Again the presence of dissolved fractions may have far-reaching consequences, but much work needs to be done in this area.

3.2.3 Threats to Biological Diversity

The global threats facing species and their habitats (biodiversity) include land use changes, overexploitation of resources, conversion of natural areas, pollution and effects of climate change. A large proportion of world population growth will take place in coastal zones of developing countries and will be accompanied by rapid urban development and changes in land and resource use. Increasing urbanization, industrial development, agricultural intensification and expansion of tourism will all have profound effects on natural habitats and species.

Urban sprawl has already proven to adversely affect biodiversity. Currently, about 50 percent of the world's urban waste-water is directly discharged into sea or other water bodies close to the sea without any kind of treatment - contributing to aquatic eutrophication and disruption of ecosystems. With intensifying demographic pressures, the sheer volume of waste products is likely to increase.

Gaseous and liquid industrial emissions and solid wastes also threaten to have an increasing impact on the environment. Expanded road networks, new dams, industrial complexes and enhanced infrastructure are likely to further stress ecosystems and reduce species diversity.

Expected increases in cultivated areas will have a significant impact on natural areas. Increases in demand for water for irrigated areas will change patterns of water flow, further altering ecosystems. Irrigation management will be vital to ensure adequate water supplies, reduce pollution from agricultural inputs and control soil salinization. Intensification of agriculture implies increased use of chemical inputs, which, without careful control, affect water quality, contribute towards the eutrophication of river and coastal marine areas, enter into food chains, and debilitate ecosystems (Clark, 1991c). Therefore, if wild species are to survive and prosper, some kind of integrated farm management should be tried (Holl et al., 1990).

Mangrove forest mismanagement and overuse are also issues of global importance. Overexploitation of forests for lumber, grazing and fuelwood needs is a common practice. Deforestation not only leads to the loss of a valuable resource, but also reduces watershed protection, increases surface water runoff, increases soil erosion and desertification, contributes to the siltation of dams, and results in the further loss of an already decimated habitat (Clark, 1991c).

The degradation of both terrestrial and marine ecosystems through over-exploitation and misuse of resources by mankind could lead to further reduction in crucial global ecosystems. Amongst the measures that could contribute to the protection of these ecosystems against these impacts are various types of marine and coastal parks and reserves, managed according to carrying capacity principles (Clark, 1991c).

3.2.4 Natural Effects

Conservation considerations are often compounded by natural disasters or other naturally occurring phenomena that impact on environmentally sensitive areas. For example, the recent spate of hurricane destruction to Caribbean coral reefs has made it difficult to assess development because the reefs are so badly broken up (Clark, 1991).

Tragedy is often brought by natural outbreaks of disease, like the one which caused massive die-off of the long-spined sea urchin throughout the Caribbean in the early 1980s. Other outbreaks such as black band disease, coral bleaching, etc., are also causes for increased concern.

Coupled with these are the feared global temperature rise which could (or already might) be altering balances in systems which may not recover from such stress, and which is probably the result of a mix of natural and human causes. Global climate change (whether natural or human-induced) will affect coastal zones. They will be impacted by sea-level rise ("greenhouse effect"), changes in ocean coastal processes, modifications of river runoff patterns and sedimentation and from the expected increase in floods, storms and hurricanes. Consequences for coastal settlements are still difficult to forecast with any accuracy but could be significant (Clark, 1991c).

One of the South Pacific's worst biological disasters is the widespread invasion of coral reef systems by Acanthaster planci (crown-of-thorns starfish) which have devastated large parts of the Great Barrier Reef (Australia) and of other reef tracts.

3.2.5 Fisheries

A major global problem is the widespread depletion of seafood resources caused by coastal pollution and critical habitat destruction along with overfishing. Lester R. Brown (1985) gives the following account of world fisheries: "Their annual harvest .... exceeds world beef production by a substantial margin.... fisheries supply 23 percent of all animal protein consumed..In many low-income countries, as well as in a few industrial ones, fish are the principal source of animal protein....millions of people make their living from supplying fish...."

In a time of rapid increase in the global need for protein, it is necessary to conserve the productivity of coastal habitats for fisheries production (the supply), as range lands are protected for livestock, farmlands for crops, and forest lands for wood. This can be effectively managed through an ICZM programme which can help prevent pollution, regulate harmful development, and create protected areas. This should be coupled with control of destructive fishing methods.

An example of coastal resources trouble brewing is the Philippines, where according to a recent study (Maclean and Dixon, 1984): "Per capita fish consumption decreased 47 percent from 1970 to 1980...prices seem to be moving upward...many believe a nutritional crisis of serious proportions is emerging." The World Resources Institute warns: "The outlook for marine fisheries is not bright. The factors that have caused recent problems - limited resources and excessive exploitation - are likely to continue."

3.2.6 Ecosystem Level Conservation

The complexity of biotic systems and the interrelatedness of their components require that each coastal water ecosystem be managed as a whole system. Neither piecemeal management nor treatment of single components or single species will fully succeed. Furthermore, the major external sources of influence on coastal water systems must be considered - shoreland watersheds, shoreline areas, and offshore waters are all linked to the coastal system. Therefore, the ecosystem defined must embrace a complete and integral unit, one that includes a coastal water basin or basins, and the adjacent shorelands to the extent that they have significant influence on coastal waters.

Also, the management programme must look to, and protect, the important ecological processes - the underlying factors which explain the high production levels of coastal seas, such as: 1) the key role of fresh and marine waters in providing and renewing nutrients, organic material, and oxygen; 2) solar radiation which is maximized as an energy source because of the characteristic shallow depths of these areas; and 3) the high mixing rates which assist gas exchange, nutrient circulation and waste removal.

4. MULTIPLE USES OF THE COASTAL ZONE

The coastal zone is used extensively and increasingly for a large number of activities. These multiple uses are not always compatible and may result in a wide array of problems for resource users and decision-makers.

Coastal land is used for human settlement, agriculture, trade, industry and amenity. The coastal sea presents problems related to transport, fishing, dumping, mining, etc., stemming from an intensification and diversification of ocean uses. There is overexploitation of fishery resources, pollution by dumping and an array of conflicts due to the interaction among user groups in congested marine areas (Clark, 1991c).

Coastal zones are the "sink" for the continents; they receive and concentrate pollutants and other negative consequences of development activities taking place in the hinterlands. In particular, the flow of rivers has often been severely modified for irrigation purposes, and they carry to the coastal areas the pollutants coming from inland agricultural and industrial activities.

Because general development may result in overexploitation, pollution or alteration of natural systems, as well as conflicts between the users for limited, but highly prized, coastal and shoreline space, its impacts must be understood and countered (Box 4.1).

4.1 Urban Settlement

The shoreline is in increasingly strong demand for human settlements, agriculture, trade, industry, amenity and marine transport activities such as shipping, fishing boats and recreational marinas. This demand, which responds to essential needs for economic growth, leads to a linear approach to coastal development focusing on the exact shoreline (e.g., the line of Mean High Water and the real estate that straddles that line) with access to recreational beaches or outstanding views of the sea. Human settlements may crowd the seas with boats, overexploit resources, generate polluting industries, produce heaps of garbage, and create large amounts of chemical wastes. While waterfront expansion may be necessary for coastal cities, it can be threatening to coastal resources if development interests do not respect conservation principles.

The shoreline is an essential natural habitat (mangrove wetlands, tideflats, and sea grass beds) easily obliterated as settlements pre-empt the shallow seas by filling for real estate. Sewage treatment, water supply, electric power production and other utilities and services add strain on available resources and on natural systems. Electric power plants require huge amounts of seawater for cooling purposes and remove great quantities of water from the coastal sea complete with their contents: a mass of small fishes and planktonic organisms destined for death in passage through the plant.

The ocean beachfront is a most hazardous place to build. The berm/foredune/ backdune system (where these exist) signal high risk locations for buildings. Keeping development far enough inland to avoid the high risk zone is important in natural hazard prevention efforts. Therefore, a setback line should be delineated at a safe point inland from the beach and all construction kept behind this line.

BOX 4.1 - COASTAL RESOURCE ISSUES LISTED BY USAID

1. Loss of mangrove forests due to rate of exploitation above that which would sustain the resource.

2. Coral reef destruction leading to reduced yield of fish species associated with reefs; reduced tourism attraction; and loss of rare ecosystems due to:

-dynamiting to harvest fish from the reef,
-harvesting of coral for construction material or, in the case of exotic coral species, for jewellery or souvenirs,
-siltation and smothering of coral from erosion associated with upstream deforestation, and
-death of coral from deleterious effluents associated with mining or oil spills.

3. Congestion and intensive use of coastal resources such as water, species, and fisheries, due to high population density and continuing growth, expansion of tourism industry, and growth of commercial and industrial activity.

4. Inadequate institutional structures to address coastal resource problems and to administer planning, management, regulation, and enforcement where it is needed.

5. Depletion of wildlife species such as turtles, crocodiles, deer, waterfowl and manatees.

6. Pollution of coastal waters which adversely affects fisheries yield and tourism revenues due to:

-industrial wastes,
-sewage,
-agricultural pesticide run-off,
-oil spills,
-bilge discharges, and
-toxic contamination of fish/shellfish.

7. Beach and coastline erosion caused by removal of coastal mangrove forests; construction of coastal installations which alter current and wave action patterns; or mining of beaches for sand.

8. Swampland filling that reduces fish spawning and "nursery" habitat and reduces fisheries yields.

9. Upland deforestation leading to erosion and sedimentation.

10. Overfishing leading to reduced fisheries yield and in some cases species extinction.

11. Salt water intrusion leading to loss of coastal agricultural lands and potable water supplies.

Source: USAID (1984)

The density of urban population creates demand for factories, power plants, warehouses, homes, docks, streets, automobiles, water supplies, resource depletion and waste disposal. It results in competition with the needs of Nature, threatens the system's integrity and impinges on the sensibilities of mankind by reducing natural diversity and creating ugliness. Although impacts are an unavoidable consequence of human survival, they often can be greatly reduced by appropriate planning and management.

4.2 Industrial Development

Industries are attracted to the coastal zones when they: 1) benefit from access to low-cost marine and inland transportation systems, 2) use seawater for process or cooling purposes, 3) deal with marine transportation, and 4) depend directly on the marine environment for raw material. Industries are also attracted by the vicinity of population centres, even when they do not depend directly on water or water access.

Coastal locations for heavy industry may engender a wide variety of environmental problems with impacts that extend considerably beyond the plant sites. A new factory may require dredging of a deep-water channel (which raises a number of ecological problems) or put increased pressure on land and air transportation links, each with its own potential for ecological disruption. Also, coastal factories have often pre-empted mangroves or other critical habitats which are obliterated by seawalls, docks, landfills, and buildings.

The waste waters from coastal heavy industries have potential negative impacts on coastal ecosystems. These impacts range from relatively minor disturbances (such as temporary, localized turbidity increase) to major disruptions (e.g., water pollution caused by discharge of toxic chemicals). But much of the industrial pollution can be eliminated by the application of existing, affordable, waste treatment technology. Also, many estuaries, lagoons, and bays which are now polluted can be successfully reclaimed if the wastes entering them are adequately treated.

Satellite industries may often be attracted in the coastal zone by the development of large factories and may be environmentally damaging, imposing higher costs on the community for streets, police, fire protection, schools, and other essential services. Therefore, planning decisions relating to industrial siting must include the secondary development such industry will induce.

4.3 Waste Disposal

Harbours of large coastal cities and industrial ports give the worst examples of pollutants discharges. Both pollution from oxygen-depleting organic wastes (e.g., sewage) and from toxic industrial wastes damage coastal environments and resources and pose risks to human health.

Lagoon and estuary degradation is often related to their fate as pollutant discharge areas. Aside from outright fish kills and other dramatic effects, pollution causes pervasive and continuous degradation that is evidenced by the gradual disappearance of fish or shellfish or a general decline in the natural carrying capacity of the system. Coastal seas are particularly susceptible to pollution conveyed by streams and rivers, including agricultural runoff.

Coastal communities are sources of serious problems of waste. Some have concentrations of septic tanks or cesspools that leach large amounts of nutrient into shallow waters. Some others dump large amounts of solid wastes along the shore which disfigure the coastal landscape and leach pollutants into the coastal seas.

Land-based sources of pollution are believed to be responsible for more than three-quarters of marine pollution, via rivers, direct discharges, and the atmosphere. Most of the rest comes from shipping, dumping, and offshore mining and oil production. Impacts of inland activities include: the discharge to coastal seas of pesticides, heavy metals, and other harmful wastes; changes in salinity regimes as a result of damming rivers and siltation due to deforestation and cultivation. Coral reefs have been destroyed and benthic communities degraded by siltation and by increased nutrients from nearby sources and by sewage and agricultural runoff. Otherwise, the damage seems to be concentrated in lagoons/estuaries, and shallow littoral waters of the open coast.

The persistence of pesticides and other chemicals in enclosed seas is of great concern. These can have a direct impact on the suitability of fish for the human diet. The need to protect human health provides a strong incentive to avoid discharges of such chemicals into the marine environment.

Excess nutrients received by the aquatic environment from land sources sometimes may enhance fisheries through increased nutrient supply, but the benefits of eutrophication seem to be outweighed, in most cases, by negative impacts (excessive algae, oxygen deficiency, etc.).

4.4 Shore Protection Works

Intertidal areas are especially important parts of the coastal ecosystem, including the mangrove forests, salt marshes, tide-flats, and beaches. They define the ecological boundary between land and sea. But, when shoreline development begins, these habitats are often the first to be obliterated - by seawalls, groins, bulkheads, and gabions.

Coastal habitats, such as mangroves and other wetlands, coral reefs, and coastal barrier islands and lagoons, are often recognized by natural hazards experts as the best defences against sea storms and erosion, deflecting and absorbing much of the energy of sea storms. If obliterated or allowed to deteriorate, storm waves and surges can pound the shore without mercy (see Figure 4.1).

Sinking and receding shorelines must be given special attention. The phenomena are caused partially by human activity and partially by the long term trend of rising sea level in response to "global warming". As the sea level rises, the shoreline will move inland. New "soft engineering" technologies which require much less concrete and rock and are protective of coastal environments are available to deal with areas susceptible to sea level rise, storm waves, storm surges, coastal flooding, and persistent erosion.

Figure 4.1 Erosion of the Seawall at Kilkhida on the Southeastern Black Sea. Source: Hayes (1985)

4.5 Ports and Marine Transportation

Port development and coastal support facilities are required by four types of activities: 1) offshore oil and gas development requires port facilities, oil storage capacity, refineries and other infrastructure support; 2) the shipping industry requires channels, port facilities, shipyards and extensive land areas for container storage; 3) fisheries development requires breakwaters, channels, ports, processing plants and other facilities for the fishing fleet; and 4) military operations will require port facilities, infrastructure, and support services. These support facilities can often be used by more than one maritime activity but military operations will usually require exclusive use of certain port and harbour sites.

Major threats from port development are: 1) pre-emption of fringing mangrove wetlands for development sites; 2) dredging channels with destructive disposal of dredge spoils; 3) dredging and filling operations, and obliteration of seagrass meadows; and 4) spills and persistent pollution. In some countries, harbours and marinas built primarily for recreational use by small boats may disturb more of the coastal zone than commercial and industrial uses.

4.6 Land Transportation Infrastructure

Roadways, bridges, airports, and other transportation infrastructure create special problems along the coast. These constructions often pollute the sea, pre-empt critical intertidal habitats, and obstruct natural water flows. Therefore, their locations and engineering designs must be carefully planned in accordance with conservation guide-lines. These infrastructure usually become development corridors and commercial nuclei and may jeopardize coastal ecosystems. They should therefore be controlled. Fortunately, planners can predict the type and extent of development caused by roadway routings and terminal locations and modify plans for the purpose of ecosystem protection.

4.7 Water Control and Supply Projects

Quantity and seasonal cycles of water flowing to the sea should be maintained because they are very important for sustaining coastal ecosystems. Many fisheries (salmon, sciaenids, herrings, shrimp, oysters) are strongly dependent upon river flows that enter the sea. These rivers may transport beneficial nutrients to coastal ecosystems and sand to the beaches. They establish beneficial brackish conditions for mangrove forests and juvenile fish "nurseries" in the estuaries as well as for nesting of colonial water birds. Dams and water diversion or withdrawal schemes can seriously unbalance such river-dependent ecosystems and reduce their productivity and species diversity by diverting water from the ecosystem or changing the beneficial hydro-period through use of store-and-release tactics created for irrigation, flood control, water supply, etc.

4.8 Sea Fisheries

Planners often underestimate the economic role of fisheries. With close to 100 million t of fish per year, the sea provides more protein worldwide than beef and mutton combined. Fisheries provide also livelihood for fishermen and their families and for others in the fishing industry, including boat builders, trap and net makers, packers, distributors, and retailers - all of which enhances social, cultural, economic, and political stability in the coastal areas. A strong domestic fishery promotes self-sufficiency and reduces the outflow of foreign exchange. Also, profitable coastal fisheries reduce rural population migrations to already overcrowded cities.

Fisheries management has been the major concern of national and regional fisheries administrations for half a century, and the UN Convention on the Law of the Sea (UNCLOS) provides its framework. This concern is being overshadowed by the problems resulting from loss or degradation of the estuarine, riverine, and coastal seas habitats. Sustainability of marine fisheries is now threatened by coastal degradation for the great majority of species that spend their youngest stages in near coast, estuarine-brackish, or fresh waters. In fact, maintenance of the present seafood production and further enhancement, through improved fishing or aquaculture, will be difficult in the absence of environmental management of coastal and enclosed seas.

In the planning process a balance is required between the need to conserve marine resources and environments for present and future generations, and the need to sustain fishing industries. The problems of overfishing are also seen in other harvests and collecting, such

as live fish for aquariums, corals and shells for decoration, and so forth. Overcollecting and use of dynamite and chemicals must be prohibited. Coral reef ecosystems are particularly beset with abuse.

4.9 Aquaculture

Marine species aquaculture spreads across the boundary between land and sea where it uses either the land (shrimp ponds) or the sea (salmon cages or artificial reefs). It represents one of the faster growing sectors of the coastal zone in some countries and is seen not only as a valuable supplement to local diets but a means of earning foreign currency through export. Aquaculture may, however, be both a petitioner for a clean environment and a polluter. On the one hand, success in aquaculture requires a clean water supply from the environment and on the other hand, intensive aquaculture practices themselves may pollute the environment.

Uncontrolled aquaculture expansion and resulting habitat conversion could reduce the natural reproduction potential of species used in aquaculture and biodiversity. It could reduce, as well, other natural values and contribute to pollution of shallow coastal waters.

Early expansion of shrimp culture required the conversion of mangrove forests to open water ponds with all the implications that loss of such wetland implies. But recently it has proved practicable to use "salinas" and other lowlands that lie behind the wetlands. In the Philippines between 1967 and 1977, aquaculture facilities accounted for 80 percent of the loss of mangrove (WRI, 1986). In Ecuador, mangrove loss for ponds is implicated in the crisis in shrimp production ("the post-larvae crisis") of the early 1980s. As stated by Snedaker et al. (1986): "To the extent that mangroves are being destroyed...there is loss of marine seafood production."

Another example is the conversion of rice fields to shrimp ponds (e.g., in East Java, Indonesia, and Khulma, Bangladesh) which require bringing saline water into agricultural areas.

Culture of finfish in impoundments and cages, in fjords and bays, can also cause environmental problems such as local eutrophication and depletion of benthic faunas through the accumulation of food residues and excrement and also toxic pollution through the escape of pharmaceutical and antifouling products. But such problems can often be overcome by locating cages in places of vigorous water circulation and regulating the use of chemicals.

4.10 Coastal Forest Industries

Mangrove forests are a major resource of the coastal zone in sheltered coastlines where wave activity tends to be moderate. They contain a high number of plants and animals (e.g., crustaceans, molluscs, fishes and birds) which form a significant part of the mangrove resource, indicating their important contribution to marine biodiversity.

In many parts of the world, human populations rely heavily upon the variety of products that can be obtained from mangrove forests such as timber, tannins, fuelwood and charcoal, honey production, and sundry domestic products. It is the various uses of mangrove forest products and the plant and animal material associated with them that lead to pressures

concerning their utilization (Table 4.1). ICZM planning, which involves simultaneous attention to all sectors and considers the maximum sustained yield of each resource, including fisheries, is an approach which is especially important in the management of mangrove forests.

The multiple use of mangroves leads to conflict between government ministries and between the economic sectors involved. Mangrove ecosystem deterioration, caused by man's intensive activities aimed at maximizing short-term gains, and the negative economic consequences on the coastal communities in both the short and long term, is causing increased concern in many countries and international agencies and calls for management. The other lowland and wetland forest types such as nypa palm, hardwood hammocks, freshwater tidal swamps, and so forth, need equal attention and management.

The removal of forest cover in watersheds, among other effects, increases sediment loadings of rivers and direct fresh water runoff to coastal seas, and this has particular effects on riverine fisheries, and on some valuable anadromous species (e.g., salmonids). It also leads to smothering of estuarine organisms such as oysters. Perhaps its most serious effect is "smothering" of coral reefs and submerged vegetation (seagrasses and seaweed beds) of key importance as fish habitat (see Box 4.2).

It is important to recognize that many of the forces which detrimentally alter mangroves have their origins outside the mangrove ecosystem. Therefore, programmes for mangrove conservation and utilization require integrated planning. One solution is to ensure that proposed developments and incidental actions that could affect the mangrove ecosystem are reviewed and approved by a governmental agency operating an ICZM-type programme. Specific conservation guidelines for mangrove forests are given by Snedaker and Getter (1985) in Coastal Publication No. 2.

4.11 Coastal Agriculture

Conversion of natural coastal lowlands to rice farming and other agricultural uses to meet food security needs create resource conflicts. Lowlands and wetlands are drained and planted but the potential of such reclaimed soils may be quite low because peaty conditions cause acid-sulphate soils and because there may be a high incidence of waterlogging. In addition, coastal lowland/wetland developments have potentially harmful side effects on coastal ecosystems; e.g., pollution from the release of agricultural chemicals into riverine and coastal waters, pre-emption of mangrove forests and other critical wetland habitats.

Lowlands conversion exacerbates flood hazards. In particular, flooding from rainstorms and cyclonic sea storms will be exacerbated by the clearing and draining of coastal lowlands and wetlands. Such floods not only destroy property and risk lives, they may also drown or salinize crops and can overwhelm estuary or lagoon ecosystems with sediment and organic and chemical pollutants.

Table 4.1 Products of Mangrove Ecosystems. Source: Saenger et al. (1983)

A. Mangrove Forest Products

Fuel	Firewood (cooking, heating)
	Charcoal
	Alcohol
Construction	Timber, scaffolds
	Heavy construction (e.g. bridges)
	Railroad ties
	Mining pit props
	Boatbuilding
	Dock pilings
	Beams and poles for buildings
	Flooring, panelling
	Thatch or matting
	Fence posts, water pipes, chipboards, glues
Fishing	Poles for fish traps
	Fishing floats
	Wood for smoking fish
	Fish poison
	Tannins for net and line preservation
	Fish attracting shelters
Textiles, leathers	Synthetic fibres (e.g. rayon)
	Dye for cloth
	Tannins for leather preservation
Food, drugs and beverages	Sugar
	Alcohol
	Cooking oil
	Vinegar
	Tea substitute
	Fermented drinks
	Dessert topping
	Condiments from bark
	Sweetmeats from propagules
	Vegetables from propagules, fruit or leaves
	Cigar substitute
Household items	Furniture
	Glue
	Hairdressing oil
	Tool handles
	Rice mortar
	Toys
	Matchsticks
	Incense
Agriculture	Fodder and green manure
Paper products	Paper of various kinds
Other products	Packing boxes
	Wood for smoking sheet rubber
	Wood for burning bricks
	Medicines from bark, leaves and fruit

B. Other Natural Products

Fish
Crustaceans
Shellfish
Honey
Wax
Birds
Mammals
Reptiles and reptile skins
Other fauna (amphibians, insects)

BOX 4.2 - MANGROVE CONSERVATION IN PHILIPPINES

CASE STUDY

Using the Philippines as an example, the major problems concerning mangroves that should be addressed by an ICZM-type programme are:

- Socio-cultural attitude towards mangrove resource utilization. There still exist different attitudes towards the utilization of this coastal resource. This may be attributed to some existing beliefs which, up to the present, are still practised. This is somehow related to the manner of how people treat it for their own use.

- Conflict between ecological function and economic resource. The mangrove area plays a significant role economically and ecologically. One of the environmental concerns is the issue on mangrove forest destruction. The conversion of the mangrove area into fishponds and into reclamation sites has been increasing so that its ecological significance has decelerated. From 1952 through 1975, the area used for aquaculture has increased from 88 681 hectares to 176 032 hectares. The increasing trend of developing the mangrove area into fishponds may have negative impacts on the coastal ecosystem. The management of the mangrove ecosystem with regard to its utilization should be given attention.

- Degradation of the mangrove ecosystem through denudation. Thousands of hectares of mangrove areas are being declared for such uses as land reclamation, human settlements and other commercial and industrial sites and purposes. The removal of the mangrove stands for such purposes has caused the deterioration of the coastal area.

Source: NEPC, 1983

4.12 Extractive Industries

Mining for beach sand has been an important industry in many countries. Sand for construction is a valuable commodity, but it must be remembered that the key to the natural protection provided by the beachfront is the sand which is held in storage and yields to storm waves, thereby dissipating the force of their attack. Consequently, taking sand from any part of the beach or the nearshore submerged zone can lead to erosion and recession of the beachfront. Therefore, beach conservation should start with the presumption that any removal of sand is adverse and should be prohibited, unless it can be shown to be naturally replaceable (i.e., it is a renewable resource).

Coral mining requires similar restrictions. It is extensively undertaken in some island countries in the Indian Ocean and Southeast Asia and leaves the shoreline exposed to erosion and storm surges, causing serious loss of beach and shoreland and damage to coastal human and marine resources habitats.

The effects of oil spills in the oceanic environment are more visible, but perhaps less serious in the long run, than discharges of nutrients and toxic chemicals, except for big spills in semi-enclosed seas - such as the extensive recent Persian Gulf "spill" - where effects of oil on coastal ecosystems and habitats essential to fisheries can be particularly severe.

Oil pollution is an ever-present danger to coastal seas ecosystems (OECD, 1990). But few countries have adequate contingency plans and emergency response procedures. Current international agreements have greatly reduced oil pollution from shipping, but they need stricter enforcement, along with provisions of guidelines. The International Maritime Organization is preparing a convention on emergency preparedness and response (1990). Sea pollution does not usually come directly under ICZM but rather a national pollution control authority.

4.13 Tourism, Recreation and Carrying Capacity

A powerful tool for national development, tourism is one of the fastest growing areas of international trade, particularly for smaller coastal countries and island countries with limited development options. It is also a potential area of conflict, particularly in developed countries where, in the absence of food security problems, pressures from recreational lobbies and public opinion (often ill-informed) may threaten fishermen's livelihood.

Environmental deterioration threatens the tourism industry in many regions. For tourism, the environment is itself a significant part of the product which a country has to offer. A successful tourism strategy will, therefore, seek to maximize the total benefits to development, while preserving the natural environment and improving the cultural milieu upon which it depends.

Beaches are the focal point for coastal recreation and tourism and a major source of revenue for many countries. The land immediately adjacent to the beach is the preferred site for tourist hotels in the Caribbean basin and elsewhere. People are willing to travel thousands of miles and spend large sums of money to lie, sit, or walk on the beach. Good beaches attract tourists and liberal spending. Degraded beaches discourage tourism.

One of the most serious impacts from tourism development, worldwide, is that of a decline in local water quality (Saenger, 1989). Sewage discharges, particularly if poorly sited or inadequately treated, are the most common source of adverse effects on the biota. For example, in the Caribbean region, less than 10 percent of the sewage generated is treated and bacterial levels regularly exceed international standards for recreational contact waters (typically 200 MPN coliforms).

Biodiversity reduction, resource depletion and human health problems may result from the accumulated environmental effects of tourism. When the situation deteriorates sufficiently, there is also loss of jobs, income, and hard currency earnings, factors that lead to socio-political instability. Such problems can be alleviated by appropriate planning mechanisms and development controls.

Many coastal countries are caught in the typical dilemma of tourism. They want the income it generates while at the same time they deplore the negative social and environmental impacts. While environmental change is an unavoidable consequence of the growth of coastal tourism, it is necessary to keep the change within acceptable bounds.

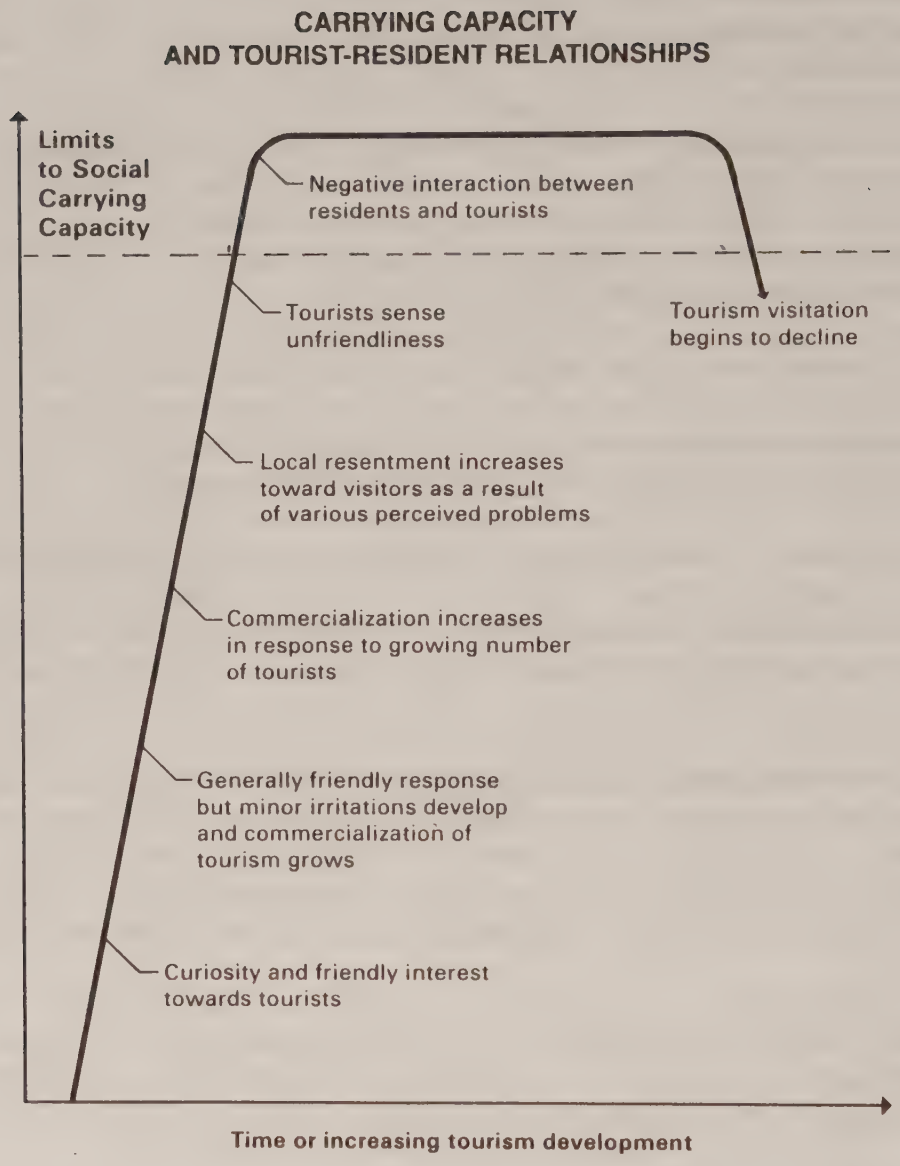
Clearly, in small countries dependent upon coastal tourism, disturbances do extend into the social and economic scene. Resource plundering and environmental deterioration are often root causes of social disruption (Figure 4.2). For example, Dunkel (1984) states that "...mass tourism subverts the indigenous culture" and that "...economic benefits have been inflated".

If tourism development is to be controlled, plans have to be formulated, guidelines and standards derived, parks and reserves have to be created, and rules have to be written, implemented, and enforced by governments. These should be based on knowledge of social and environmental carrying capacity and proved methods of visitor management (Clark, 1991a). Carrying capacity refers to the capacity of an ecosystem to sustain specified resource uses.

Sadler (1988) believes that the idea of carrying capacity provides a frame of reference for tourism and " ... is widely used to underline the importance of maintaining a level and mix of development which is environmentally and culturally sustainable".

It should be noted that carrying capacity is not fixed but can be reduced by human or natural damage or increased through selected management procedures (see Box 4.3). The Economic Commission for Latin America and the Caribbean (ECLAC, 1985) reports that to their knowledge, megascale carrying-capacity levels are only estimated for Barbados, Saint Croix Island (US Virgin Islands) and Bermuda. In the case of Bermuda, capacity was established at half a million visitors annually based on physical carrying capacity levels (e.g., maximum 14 500 hotel rooms). Barbados used limitations on docking space and the US National Park Service at Saint Croix has limited the number of commercial tour boats allowed to go to the Buck Island coral reef daily.

Also, it should be noted that the Seychelles Islands in the Indian Ocean recently declared that their tourist capacity had been reached and announced a prohibition on future increases. Ecuador set a limit for the Galapagos Island National Park of 12 000 visitors/year


CARRYING CAPACITY
AND TOURIST-RESIDENT RELATIONSHIPS
Limits to Social Carrying Capacity
Negative interaction between residents and tourists
Tourists sense unfriendliness
Tourism visitation begins to decline
Local resentment increases toward visitors as a result of various perceived problems
Commercialization increases in response to growing number of tourists
Generally friendly response but minor irritations develop and commercialization of tourism grows
Curiosity and friendly interest towards tourists
Time or increasing tourism development

Tourist-Resident Relationships: A Theoretical Model

Figure 4.2 Carrying Capacity and Tourist-Resident Relationships
Source: Murphy (1983)

BOX 4.3 - METHODS OF CONTROL FOR LOWERING VISITOR IMPACT

The following visitor control measures may be employed to reduce visitor impacts and/or increase carrying capacity at coastal and marine national parks and reserves (created by participants of the Third International Seminar on Marine Parks).

ADMINISTRATIVE

1. Concessions: Control numbers/activities by limits on concessionaires (lodging/ meal facilities, tour operators, etc.).

2. Time separation: Includes seasonal closure and time intervals.

3. User fees: Controls numbers by "ability to pay" the fee.

4. Speed limits: Also engine horsepower, size and type of craft.

5. Activity restriction: e.g., no spearfishing, jet-skiing, etc.

6. Access restrictions: Special places (zones) and time periods.

7. Zoning: For assigning specific uses to specific areas; this is considered the most fundamental measure, always to be done.

8. Quotas: Numerical limits on visitors; the most direct method.

PHYSICAL

1. Signage/exhibits: For directions and education/awareness.

2. Trails/routings: Surface or underwater to guide visitors.

3. Mooring buoys: Reduce anchor damage, provide positioning, and control numbers of boats on a site.

4. Ramps and docks: Limit launchings, provide orientation.

5. Guides: Guidebooks, brochures, enhance visitor awareness.

6. Transport: Special interpretive craft (subs, glass bottoms).

7. Dry observatory: View of nature without entering the water.

8. Artificial habitat: Enhances nature and attracts visitors.

Source: Adapted from Clark (1991c)

in 1973; raised it to 25 000 in 1982 but actually allowed 47 000 in 1990. Everglades National Park (Florida, USA) was unable to set a carrying-capacity for the fishery in Florida Bay, so banned it completely.

Many marine parks, particularly coral reef parks, are installing special boat moorings in visited areas and discouraging visitors from free-anchoring. In this way, the visiting boats can be limited in number and located appropriately - when the time comes for control. Looe Key Marine Sanctuary (Florida, USA), with 52 such moorings, is a good example of this approach.

After considerable study, Costa Rica has set limits on the number of tourists that can visit sea turtle nesting beaches; for example - 25 per night at Nancite Beach (Santa Rosa National Park), to protect seabirds; Queensland (Australia) limits beach occupancy to 100 persons at Michelmas Cay.

Its advocates hope that through "ecotourism", the more rapacious resource activities, such as clear-cutting of mangroves, mining of coral reefs, and hunting of endangered species, can be discouraged in favour of the lighter footprint of selective tourism - much of it directed to national parks and nature reserves.

However, carrying capacity has to be addressed to ensure that natural resources are not overused nor the parks overwhelmed by tourists. Ecotourism is no miracle solution for environmental problems - development control based on carrying capacity is still necessary.

4.14 National Security

Extensive security interests exist in the coastal zone and coastal seas because they are at the frontier, the border zone, where invasion or other negative activities (smuggling) might occur. Naval ports and harbours, coastal airfields, and special bases of all kinds are sited in the coastal zone, usually with a high priority and intense security. However, with the correct approach, the military can be expected to cooperate in coastal zone conservation so long as it is not in conflict with national security needs. Therefore, the defence establishment should be included as a party to any ICZM programme.

4.15 Lagoons and Estuaries

As mentioned in section 3, coastal lagoons are special habitats for biological resources but also the locus of substantial economic activity (e.g., in the Caribbean, in West Africa and in the Mediterranean). The pressure on them will increase as the population and economy of a country expands. Fisheries, shipping, commerce, industry, tourism, housing, and institutions all crowd along their shores and, if this growth is not managed, the result can be rapid and severe degradation of the lagoon ecosystems and loss of natural resources. Large areas of lagoons and estuaries have been reclaimed (drained and/or filled) to create ports, real estate or agricultural land, most notably in land-scarce regions (such as in Japan and the Netherlands). Improperly planned, sectorally-oriented development along the shores of estuaries and lagoons creates a variety of short and long-term economic losses and opportunity costs as the result of resource collapse.

Impoundment or diversion of rivers at the upstream locations add threat to the well-being of estuaries/lagoons. When portions of the coastal watershed system are altered or short-circuited, the natural flow pattern is disrupted and estuaries may be subject to surges of fresh water. This not only disturbs the eçosystem, but also increases flood hazards.

Enclosed and semi-enclosed seas (such as the Mediterranean, the Baltic, the Red Sea and the Black Sea) are particularly vulnerable because of their limited area and relatively shallow nature, the high density of the populations they support and, as a consequence, the high density of industries using their shores. The problems are exacerbated by the relatively low level of exchange of their waters with larger oceanic areas.

Confined embayments need the maximum protection: wetlands, tidal flats, and beaches conservation; establishment of "buffer strips" around wetlands; control of sewage and storm drainage effluents; adoption of safeguards against runoff of soils, fertilizers, and biocides from the coastal upland; restrictions on industrial siting; and so forth.

5. PRINCIPLES AND PREMISES

ICZM is based upon fundamental premises and principles. Those appearing below were adapted from a report prepared for the US National Park Service (Clark, in press). While the degree of specificity to ICZM is self-evident for most of the principles and premises, the list is arranged so that items more specific to ICZM appear toward the beginning of the list and those of more general application toward the end.

5.1 Principle 1: The coastal area is a unique resource system which requires special management and planning approaches

The major resource systems of the coast have no equal on land. Coastal ecosystems and key coastal habitats - such as coral reefs and mangrove forests - are not only distinctive, but extremely productive of renewable resources. Clearly, traditional land-based or marine-based forms of management and planning must be modified to be effective for the coast, at the transition between land and sea.

From the natural sciences point of view, the coastal area is an extremely complex, highly diverse, and complicated system - a complexity that ensures a continuing high need for help from scientists in the coastal planning sphere. From a planner's viewpoint, the coast is a place with an inherently incomplete database and where major influences - e.g., storms, erosion, fish migrations - are usually unpredictable and where land-based planning principles are often irrelevant.

Sea fisheries, important in many ways, have no terrestrial counterpart. Seafood is recognized as a critically important resource (Brown et al., 1985); it provides more protein worldwide per caput per year (6.5 kg or 16.1 lb) than beef and mutton combined (5.1 kg or 12.2 lb). Yet economic planners take slight notice, perhaps because seafood production is a mysterious pursuit carried out far from cities and incomprehensible to most persons. Also fisheries are variable and, in large measure, unpredictable and unprogrammable in the usual economic sense.

Some of the most difficult resource conflicts of the coastal zone arise from conversion of coastal lowlands from natural habitats to agriculture uses. To the upland economic planner it may seem logical to drain and plant the lowlands and wetlands, until discovering that the potential of soils in coastal lowlands is usually quite low because peaty conditions cause acid-sulphate soils and because there is a high incidence of flooding. One must be very cautious with mangrove swamp or brackish transition swamp/marsh conversions to agriculture. For example, Burbridge and Stanturf (in press) see agriculture on the Southeast Asian coast as a risky business, particularly in making careful decisions about using soil sites that require continuous high levels of management to achieve socio-economic benefits. Also, lowland/wetland developments have potentially harmful side effects; e.g., the release of agricultural chemicals into riverine and coastal waters.

No realistic amount of investment can overcome the natural forces which have created these lowland/wetland areas or the natural hazards which will continue to influence their use. And there is also a danger that hazards such as periodic flooding will be exacerbated by poor

management of clearing and draining in coastal lowlands leading to flash floods. Such floods pose serious risks to farmers (Burbridge and Stanturf, in press) and can overwhelm estuary or lagoon with pulses of sediment, organics, and chemical pollutants.

Another example of special ICZM problems is urban waterfront development, which is both vital to coastal cities and threatening to coastal resources. High quality shorefront land parcels are in high demand, particularly those that extend to and/or across the intertidal zone and carry such values as ship berthing, access to fishing, access to the beach for tourists, and unobstructed view of the sea from home or apartment. With this focus at the water's edge, the development planning context tends to narrow to a linear approach; that is, it focuses on the Mean High Water line and the properties that straddle that line.

Because of the general scarcity of good shorefront land and its importance to coastal communities, both centrally planned and free market countries have reason to allocate coastal land uses within a broader social perspective than ordinary land and take a longer-term, more comprehensive and integrated approach, one that includes conservation and social equity needs as well as economic growth objectives. For example, in the USA "non-waterfront dependent" uses of waterfront land are typically discouraged and usually denied if negative environmental effects are predicted (by exercise of state CZM or Federal permit authority). Planners should attempt to keep options open for future high priority development.

As these few examples show, the special characteristics of the coastal zones require special planning and management approaches, such as those found in ICZM-type programmes, approaches which anticipate and deal with unusual problems and the unique conflicts that arise along the coast. It is clear that those who work with ICZM programmes should have special training and experience.

Unfortunately, the place where the land ends is also the place where the knowledge and experience of most administrators ends. Planners, managers, engineers, and politicians alike are usually not well informed about the sea and the sea coast. Those who do have knowledge are usually experts in particular subjects - navigation, fisheries science, or hydrodynamics - who know the sea and seacoast from a specialist's point of view rather than from a systems perspective. Those few who have prepared themselves to know the sea and seacoast as a natural system and who understand the interactions of sea and coastal land, are exceptionally important to ICZM programmes. Only recently has formal graduate level training been available to those who would choose to make ICZM a career. ICZM is recognized as an interdisciplinary pursuit, not as a distinct discipline.

5.2 Principle 2: Water is the major integrating force in coastal resource systems

Every aspect of an ICZM programme relates to water in some way, requiring the creation of unusual and sometimes complex institutional arrangements. Water provides both the economic base and the social and cultural structure for coastal communities. It provides beaches and viewscapes and gives rise to traditions of fisheries and maritime shipping. But water also erodes beaches and floods coastal cities in response to storm events.

Virtually all of the water of interest to ICZM is moving water; it is either oscillating with the tides or running down from the land in rivers. Ocean currents bring salty waters

from the ocean to mix with fresh water from the land along the open coast or in lagoons and estuaries. In humid coastal areas where extensive fresh water discharge dilutes seawater, salinity level is a principle determinant of the type and abundance of species that are present.

Being at "sea level" elevation, the coast is the eventual receiving basin for all land runoff water and the wastes it carries. Consequently, a large share of the world's pollution ends up in coastal lagoons, estuaries, wetlands, submerged grass beds, and coral reefs. Coastal discharging rivers not only bring pollution, they also gather and bring rampaging flood waters into the coastal plain.

In summary, because it operates at the water/land interface, every aspect of ICZM relates to water in one way or another, whether making provisions for marine commerce or the ravages of sea storms, or resource conservation, or pollution abatement. The water influence not only establishes special conditions, it also dictates unusual and complex institutional arrangements. In most countries a great variety of agencies have interests in coastal waters, interests that are sometimes complementary but more often competitive. The value of an ICZM programme is that it can serve to coordinate all the varied interests in coastal resources and coastal development.

5.3 Principle 3: It is essential that land and sea uses be planned and managed in combination

The ICZM process recognizes coastal shorelands, lowlands, intertidal areas, lagoons, and open waters as a single interacting and indivisible resource unit that lies between the upland and the open sea and whose future must be planned and managed in combination. Ecologically, any uncontrolled development activity located anywhere near coastal areas - in watersheds, floodplains, wetlands, tidelands, or water basins - has the potential for damage to the coastal waters ecosystem.

Between the geographic extremes of the hinterlands and the deep sea, falls the area usually delineated as the ICZM planning zone - the transitional strip of land and sea that straddles the coastline including the narrow edge zone of mostly intertidal habitats. This strip contains some of the most biologically productive and economically valuable habitats of the biosphere, including estuaries, coastal wetlands, and fringing coral reefs. But it must be recognized that this area also contains dense human populations and undergoes great environmental modification and deterioration through landfill, dredging, and pollution associated with urban, industrial, and agricultural development. It is the core area of the ICZM programme.

The relationship between the "dryside" and "wetside" of the coast - that is, between the terrestrial and the marine realms - precludes the effective management of a marine or estuarine resource system without concurrent management of adjacent land habitats. Therefore, the proposition that coastal ecosystems must include both dryside (land) and wetside (water) components and that they should be managed together is considered fundamental. Development planners must recognize, particularly, that modification of the land area (e.g., land clearing and grading) has a high potential for adverse effects on lagoon or

estuarine coastal systems (Figure 5.1). It follows that ICZM must address land modification activities, principally those associated with site preparation for development (Clark et al., 1980).

This emphasis on the land/water interface of the seacoast and its particular influences makes the ICZM process unique in the realm of integrated planning and management.

5.4 Principle 4: The edge of the sea is the focal point of coastal management programmes

Although the coastal zone may be drawn broadly or narrowly, it always includes the water's edge - the boundary line between land and sea that includes the subtidal, intertidal and supratidal zones. This is where authority changes abruptly, where storms hit, where waterfront development locates, where boats make their landfalls, and where some of the richest aquatic habitat is found. It is also where typical terrestrial type planning and resource management programmes are at their weakest. The edge zone includes coastal floodplains, mangroves, marshes and tidal flats, beaches and dunes, and fringing corals. It is a place of great dynamism and energy.

The habitats, species, and other resources under the purview of ICZM planning would include the areas from a defined upland limit downslope, or through lowland, dunes, and flood lands to estuaries, swamps, beaches, shallow waters, and perhaps even extend to include the smaller coastal islands. In the open waters, the management programme should focus on shallower nearshore coastal waters, but it could in some cases extend seaward.

The water's edge is also the place where the greatest competition and conflict between users is found and where governments need to develop the type of special policies and programmes that ICZM offers. Experience with developing ICZM type programmes in several countries indicates that while the policy and planning agenda may cover a wider coastal zone, the operating programme itself will usually target the narrower edge zone.

5.5 Principle 5: Coastal management boundaries should be issue-based and adaptive

There is no single description of "coastal area" or "coastal zone" for the ICZM process; boundaries are delineated on the basis of the particular problems that ICZM attempts to solve. The boundaries must be adaptive to the goals and objectives.

According to Sorensen and McCreary (1990), boundaries for integrated coastal management programmes should be tailored to capture, and enable resolution of, all the major coastal issues. Because there is a broad array of possible coastal issues, there is a broad array of possible ICZM management boundaries. Some boundaries are quite narrow, and are best suited to deal with use conflicts occurring at the immediate shoreline. But if watershed generated impacts are serious, then a coastal management boundary extending far inland would be justified. The ICZM zone of jurisdiction may be based on political and administrative considerations as well as economic and biogeographic ones (Snedaker and Getter, 1985).

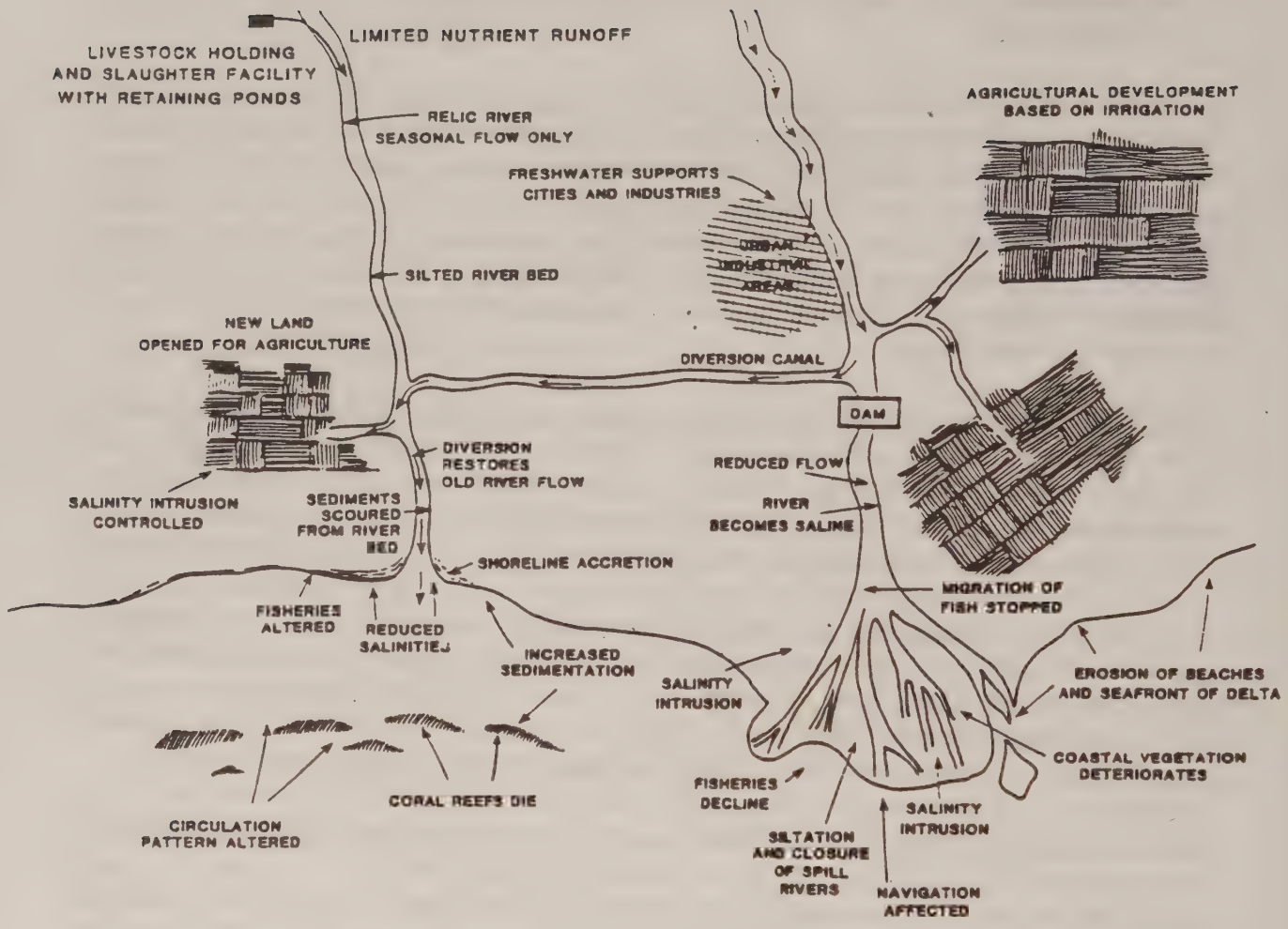


Figure 5.1 *Impact of Upland Agriculture on Coastal Resources. Source: Snedaker and Getter (1985)*

It would be valid to include in the coastal zone all areas that have an influence on coastal waters. But this definition could be politically self-defeating if it encompasses all coastal plains and the watersheds of all streams and rivers that drain into the sea (which at times extend hundreds of kilometres inland) because of so much resistance to such a broad area of control. But, it is necessary to have some input into how resource uses are controlled in the watersheds which are the sources of excessive siltation and chemical pollution of coastal waters.

It might also be valid to set the seaward ICZM boundary at the edge of the continental shelf (as defined by the 1982 United Nations Convention on the Law of the Sea) or even the exclusive economic zone (200 mi or 320 km), if important land use/water use management issues extend that far seaward. In any event, the concept of coastal zone should reflect all the different legal regimes within it, such as, internal waters, territorial seas, contiguous zone, continental shelf, EEZ, and also, where they might be useful, straits, regime of islands, archipelagic states, etc. (M.T. Cirelli and M.A. Mekouar, Legal Officer, FAO, pers. comm.).

Use of the term "coastal zone" (as in ICZM) indicates that the coastal zone has been distinguished as a geographical zone apart from, yet between, the oceanic domain and the hinterlands (the terrestrial or uplands domain). For example, the Sri Lanka ICZM programme has authority over a zone that extends from 300 m landward of the mean high water line to 1 km seaward of the mean low waterline; the landward boundary may be extended to a maximum of 2 km inland where rivers, lagoons, or estuaries occur (CCD, 1986).

In the first regional ICZM programme in the USA, the San Francisco Bay Conservation and Development Commission, successfully protected the Bay with jurisdiction for a zone that extended only 100 feet (30.48 m) inward of the water's edge (Mean High Water). In another example, the ICZM programme for Washington State covers only 200 feet (60.96 m) of the edge zone. Such narrow zones function satisfactorily in the USA because numerous other federal and state laws control actions in the intertidal area and near coast waters seaward of the edge zone and in the shorelands landward of the edge zone.

In summary, the geographical jurisdiction of ICZM is variable but the ICZM programme will be the most effective when its geographic scope is the most limited. The ICZM zone has both inland and ocean boundaries. Small islands would be included in toto as long as they were within the ICZM oceanward boundary. Given the environmental, resource, and governmental differences among coastal nations and subnational units (provinces, towns) there is considerable variety in the selection of boundaries to delineate both seaward and inland extent of the ICZM zone.

5.6 Principle 6: A major emphasis of coastal resources management is to conserve common property resources

While planning and management strategies may of necessity include some control on use of private lands and private activities, a major purpose of ICZM is the caretaking of common property resources of the wetside of the coast, such as coastal waters, coral reefs, or mangrove forests. Management of common property is an important function of government and one that often receives too low a priority; as stated by J. Gritzner (1986),

"...neglect of common property issues is often a principal cause of failure in development projects...".

The resources of most critical concern to ICZM are along the edge of the coastal sea, in lagoons and estuaries, and in the transition zone of beaches, mangroves, and tidal flats. In most countries these places are not owned by individuals or private entities, but are "commons" where the public has more or less free access and use. Therefore, the resources of coastal areas are the responsibility of governmental agencies. Depending upon traditions and circumstances, jurisdiction may be shared in any combination of entities: national government, state or provincial governments, tribal chiefs (in some South Pacific countries) and so forth.

The edge zone of intertidal and shallow areas may be the most ignored part of the coastal commons and the one in most need of management through ICZM programmes. Therefore, in the ICZM planning phase, a priority should be given to understanding the use, jurisdiction, and issues concerning these edge zone resources (see preceding section).

5.7 Principle 7: Prevention of damage from natural hazards and conservation of natural resources should be combined in ICZM programmes

Water-related disasters are virtually inevitable in any coastal nation. They result from cyclonic storm attack, tsunamis (gigantic tidal waves), shore erosion, coastal river flooding, landslides and mud slides, and soil liquefaction. It is usually neither economically feasible to eliminate the hazards through engineering (e.g., by building giant seawalls), nor to exclude all people and structures from the hazard zones. Most societies have developed administrative and social mechanisms to cope with the aftermath of extreme natural events (post-disaster relief). However, prevention of the same type of hazards is often ignored and thus development processes which increase the level of coastal hazards are free of control. This would appear to be a situation which should be remedied when one considers the high loss of life and property from natural hazards (e.g., an average death toll of 34 360 persons per year from cyclonic sea storms alone, reported by the Swedish Red Cross for the 1970s).

In addition to their ecological values, such coastal resources as reefs, beaches, dunes, and mangroves form important natural defences against wave action. Reefs act to "trip" storm waves, reducing their strength as they pass over the shallow depths. Beaches and their dunes and offshore bars are also efficient dissipators of wave energy. Where beach sand is deposited in bars offshore, water depth is decreased and storm waves break farther from shore; if the sand is deposited landward (in dunes) the effective width and volume of the beach is increased, further reducing the danger of severe loss of beach to destructive waves.

The ICZM-type programme is the best vehicle for combining coastal natural hazards prevention and resources conservation. As many experienced planners and managers already know, the measures best suited to conserving ecological resources are often the same as those needed to preserve the natural landforms that serve as barriers to storms and flooding.

The Philippines, Bangladesh, Saint Lucia, and dozens of other countries are affected by serious storms and flooding. This risk, and that from other hazards could be lessened through controls on type, density, and location of settlement through initiation of effective

ICZM programmes. Of particular importance in such programmes is the maintenance of natural landforms that take the brunt of storms and therefore protect lives and community structures. An example is Bangladesh where 100 000 hectares of fringing mangrove forest were planted in the 1980s with World Bank financing. On 29 April 1991, when a rampaging cyclone struck the Bangladesh coast, many thousands of lives were saved by the mangrove "wall".

A leading example of the use of ICZM for hazards prevention is the Sri Lanka programme which was motivated by coastal erosion and storm damage caused by mining of coral reefs (see Box 5.1).

Combining the dual goals of conserving coastal resources and maintaining nature's hazard protection systems can save money. Because of the link between uncontrolled development and disasters, an important aim of ICZM is to integrate the knowledge of coastal hazards and risks into development standards and planning guidelines. Specific guidelines for estimating the hazard risk level of a project or programme should be applied to every development proposal. This would ensure that projects do not unnecessarily increase risk and, further, that they can be implemented in a way that reduces existing hazard risks and is cost-effective. An example worth studying is the massive runoff from rainstorms associated with a major "El Nino" event in 1983 which caused high property damage to the Ecuador coast and also disabled much of the aquaculture industry.

In summary, fully comprehensive ICZM programmes include both natural hazards prevention and coastal resources conservation (Sorensen and McCreary, 1990) using similar methods to accomplish both objectives.

5.8 Principle 8: All levels of government within a country must be involved in coastal management and planning

Coastal resource management requires involvement by all levels of government. The local governments are involved because they govern where development takes place, where resources are found, and where the benefits or penalties are mainly to be felt. The central government has to be involved because responsibility and authority for marine affairs inevitably rests there (navigation, national security, migratory fish, international relations, etc.). Intermediate levels of government - e.g., state (provincial) or regional - are involved because all entities which have responsibility in the coastal area have a role in the ICZM process.

Coastal areas are governmentally complex and require a high level of intergovernmental coordination. Some of the reasons are given below:

- the amount and complexity of public interest in coastal areas are high;
- the effects of conflicts and impacts of one sector on another that require government intervention are exceptionally high;
- there is considerable involvement with public (common property) resources and their conservation;

BOX 5.1 - SRI LANKA'S COASTAL ZONE MANAGEMENT PLAN

CASE STUDY

Sri Lanka's Coast Conservation Department (CCD), the nation's lead agency for coastal zone management, has recently completed a draft of its first legislatively mandated national Coastal Zone Management Plan (CZMP), culminating four years of intensive work. The CZMP focuses on three national priorities:

- erosion management
- loss and degradation of coastal natural habitats
- protection of scenic areas and cultural and religious sites.

The CZMP, which was developed in close coordination with other Sri Lankan agencies, concerned about and responsible for coastal resources represents the best available analysis of the nation's coastal problems. In addition, it provides both a policy framework and a practical strategy for dealing with the problems.

Management strategies, which include regulation, research programmes, enhanced intergovernmental coordination and public education, are presented for each priority issue. For example, the erosion management strategy establishes a setback line to ensure that structures are not sited so close to the shoreline that they contribute to or are affected by erosion. Regulatory measures prohibit the construction of shoreline protection work in some geographic locations, while they establish review procedures for constructing such structures along the rest of the coast. In addition, coral and sand mining are regulated. Both activities accelerate the rate of coastal erosion in areas with already serious erosion problems. Also included in the erosion management strategy are: a public education campaign targeted at coral and sand miners regarding the impacts of their activities, a programme to identify alternative employment for displaced coral miners, and a research effort to identify alternate sources of lime for the building industry. Complementing these management efforts is a public investment programme to build shoreline protection works in appropriate areas.

Source: Olsen (1987)

- water is a fluid resource which is not containable or ownable in the usual sense, and which simultaneously affects all coastal interests;

- a greater variety of coordinated multi-governmental policy decisions is required in coastal areas; and

- there tends to be a high level of international interest in coastal matters.

The immediate shorelands (the dryside) are usually subject to more local or provincial government control and less central government control. However, non-development zones that exclude most private use may be imposed by central government to prohibit private encroachment into wetlands or beaches, or to guarantee unrestricted public access to the public resources of the shore (Sorensen and McCreary, 1990). An example is Costa Rica where much of the mangrove coast is protected.

For the marine and transition areas (the wetside) central government authority is prevalent. In the intertidal zone - wetlands, tidal flats, beaches - the "public trust" is often strongly asserted, which, in turn, invokes central government control. Central governments usually act as the "trustees" of the common (public) property of coastal areas.

For the uplands, or hinterlands, the practice in most nations is to exercise even less control than for coastal areas. Exceptions may be found among nations with strong programmes for land use planning or town and country planning (e.g., United Kingdom) or nations with strong centralized economic development programmes (Sorensen and McCreary, 1990).

By comparison, most social policy areas (e.g., criminal justice, public education, and health care) involve relatively fewer government sectors than coastal management. The greater the number of sectoral divisions within a policy area (such as ICZM) the greater the potential for fragmentation of governmental responsibility and duplication of effort.

In summary, coastal areas and coastal resource systems are governmentally complex because of the degree of shared jurisdiction and the amount of common property resources involved. Therefore, ICZM activities need to involve all levels from national to village governments.

5.9 Principle 9: The nature-synchronous approach to development is especially appropriate for the coast

The most cost-effective approach to coastal development and coastal engineering is one that respects the strength of natural forces operating at the coast and that designs projects to utilize or adapt to these forces - this is the "nature-synchronous" or "design with nature" approach (McHarg, 1969).

Countries with limited investment capital and a critical need for food and economic betterment cannot afford to waste their money on overly expensive or ineffective structures. Yet this has happened too often with projects engineered to defy natural forces and ecological processes. Natural forces are exceptionally strong in coastal areas - wind, waves, erosion,

storm surges, and tides. The beachfront is a place of extraordinary release of natural energy and a place where mistakes can be very costly. Special risks are attached to development on the ocean beachfront, where buildings are directly in the path of storm-driven waves.

Beaches and dunes shift with changes in the balance between the erosive forces of storm winds and waves, on the one hand, and the restorative powers of tides and currents, on the other. Consequently, along much of its length, the coast is a risky place to maintain habitation. The costs in property losses and human lives have been high. Furthermore, enormous sums of public money are spent on "hard engineering" efforts to stabilize and safeguard beaches. These efforts are rarely rewarded with success.

"Soft engineering" - a nature-synchronous approach - offers a more cost-effective alternative to "hard engineering" and that works well in many, but not all, situations. For beach projects, the soft engineering approach recognizes that the natural beachfront exists in a state of dynamic tension, continually shifting in response to waves, winds, and tide and continually adjusting back to an equilibrium state. Long term stability is gained by holding the slope or profile of the beach intact by balancing the sand reserves held in various storage elements - dune, berm, offshore bar, and so forth. Each component of the beach profile is capable of receiving, storing and giving sand, depending on which of several constantly changing forces is dominant at the moment. The storage capacity of each of the components must be maintained at the highest possible level. This can be facilitated in some cases by proper design in locating wave absorbing structures (rip-rap) rather than wave-reflecting structures (concrete bulkheads).

Many applications of nature-synchronous engineering approaches for beach stabilization can be cited; for example, harbour inlet stabilization, dune management, and beach replenishment. There are other applications such as vegetated storm water drainage ways and buffer strips (instead of concrete ditches), mangrove buffer strips along channels (instead of bulkheads), and retention of flood plains to store flood waters (rather than concrete storm water canals). Most soft engineering approaches have less damaging impact on coastal renewable resources than hard approaches.

In summary, in both planning and in management (project review/environmental assessment) phases, preference should be given to nature-synchronous options (Figure 5.2).

5.10 Principle 10: Special forms of economic and social benefit evaluation and public participation are used in coastal management programmes

Because numerous economic sectors are influencing the coastal area, one must examine the economic "externalities" of each. When any one sector attempts to gain the highest economic yield from its activities, it often attempts to avoid responsibility for its external effects. For example, a factory operator may wish to avoid financial responsibility for the degradation of fisheries or inhibition of tourism caused by his factory wastes polluting a bay. The ICZM process examines the effects of "externalities" of any one sector on other sectors, most importantly the effects of "dryside" (shoreland) private activities, upon the common resources of the "wetside" of the coastal area.

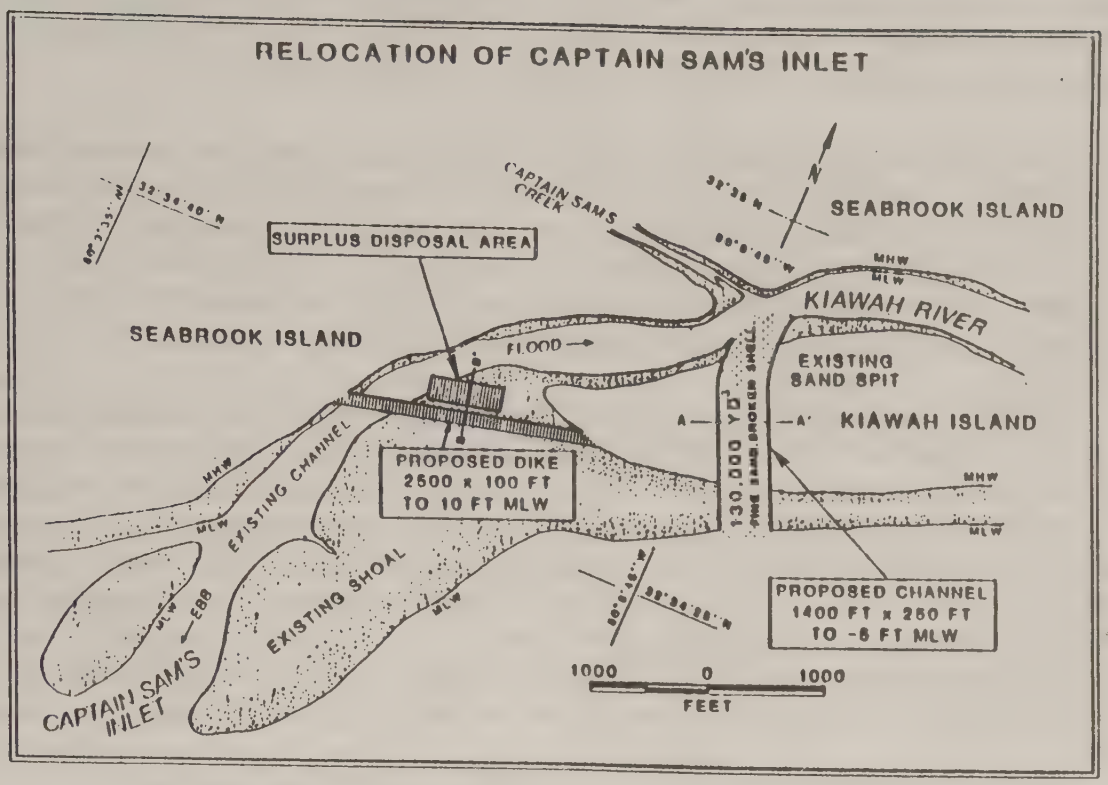


Figure 5.2 ***The plan for relocating Captain Sam's Inlet using "software engineering" principles. The project freed a large volume of sand trapped at existing inlets to renourish the downdrift beach. Source: Hayes (1985)***

Burbridge and Koesoebiono (1981) point out that it is difficult to assess ecosystems adequately applying economic techniques normally used in project planning. First, many of the goods and services produced by these systems in their natural state are not easily expressed in cash terms; and second, many of these goods and services are harvested "offsite", that is, they are external to the discrete ecosystem and become economic externalities within adjoining systems.

The absence of quantifiable market values for many "environmental" goods and services does not present an insurmountable problem because qualitative assessments of their significance can be incorporated into a carefully constructed analysis. However, while some factors can be quantified (e.g., expected changes in income levels), others are not quantifiable (impact upon traditional lifestyles). Both types of effects should be researched and brought together with other relevant information as part of the package of factors to be considered.

Burbridge and Koesoebiono (1981) note that there are two broad considerations concerning human resources. The first is assessing the negative or positive impacts of development programmes and projects on the people who will be affected. The second concerns consultation with these people in the project formulation, planning and implementation processes.

International donor agencies normally have some broad social objective in stimulating development. Therefore, a more broadly based assessment of projects and the ecosystem framework within which they operate is required, one which expresses a development project's impact upon society as a whole. Factors that are often excluded from financial analyses - such as the costs imposed by pollution - should be considered by donor agencies and project planners in an economic analysis (Burbridge and Koesoebiono, 1981).

ICZM programmes require the highest level of public participation possible or appropriate (Box 5.2). People who live along the coast and have traditionally used coastal resources may be greatly affected by new rules and procedures. Therefore they must be involved in the formation of new coastal policies and rules on resource use, if they are to support them. To the question "Why should local communities support sustainable and ecologically sound uses?", Alan White (1987) replies as follows: "Traditionally, these communities understand the limits to natural marine ecosystems and productivity, but in the modern, overpopulated world, this tradition is being lost." White (1987) develops the argument further in the following statement about support for coastal parks and protected areas:

> "Education and good examples (pilot projects) can show and remind people what is possible in terms of sustainable use and the value of protected areas. But education is not participation. Participation comes from wanting to support common values to gain some real or perceived benefit for the individual and community. Without it, marine resources can never be conserved and sustained because "enforcement" of laws in such a commons is not practicable. When people decide to "participate", they as resource users will make the real difference in protected area management. The solution thus lies in helping people to decide to participate in a constructive manner. Once resource users decide to do so and receive the associated benefits, the process will perpetuate itself."

5.11 Principle 11: Conservation for sustainable use is a major goal of coastal resources management

An important ICZM premise is that coastal renewable resources should be managed to produce benefits on a long-term, sustainable, basis. Sustainable use is the alternative to resource depletion that accompanies excessive exploitation for short-term profit. A corollary is that development projects should be designed to sustain themselves without continued subsidy. According to Burbridge and Koesoebiono (1981), there are major physical,

BOX 5.2 - CITIZEN PARTICIPATION IN CAMP

Participation is a tool available to the entire management community (resource users, public agencies, non-governmental organizations, etc.) to ensure the effectiveness of management solutions. Participation is a duty because the issue remains above all one of human development and because people are not the object of that development but the subject of development and the makers of their own history. It is an instrument of democracy and a guarantee for the overall improvement in the quality of human life.

Nor is participation a "way to sell pre-made decisions". It should be a consultation with ideas growing in both directions. Planners and managers too often resort to public participation and involvement only because a particular management decision is difficult to enforce or encounters opposition.

If we were to attempt a definition of participation, we would see it as a true dialogue between all parties concerned with a particular resource in order to ensure that there is a sharing of agendas. Participation is not intended to change the views of the fisherman, the government officials, the planners or the consumer. Nor is it a means to get a particular group or sector "aligned" to the needs of another group. What it does is to ensure that we move from single sectoral concerns and individual concerns to a collective agenda which all parties will be better armed to address. Participation serves to unite people in the sharing of needs and ideas and in the working of solutions.

More specifically, the objectives of participation can be placed at four levels:

- participation is a way to ensure that popular knowledge and experience is indeed integrated into the planning and management process

- participation ensures that all needs and priorities are taken into account in the formulation of management decisions

- participation gives a better guarantee for the quality of the solution identified and for its adaptation to a particular condition

- participation in planning and problem identification promotes involvement in the actual implementation of decisions.

Source: Renard (1986)

biological and socio-economic factors involved in determining the levels of reasonable resource exploitation. This involves conscious economic choices by individual societies on the allocation of scarce capital, manpower and technology. Recently there has been a shift in political reasoning away from exploitive, non-sustainable uses, which are expensive in terms of management costs and risky in terms of the foreclosure of future development options. In the ICZM process the priority is given to resource uses that are sustainable.

As explained by Snedaker and Getter (1985), in most parts of the world, renewable coastal resources tend to be economically limited. Over time, the economic demand for a given resource will commonly exceed the supply, be it arable land, fresh water, wood or fish. Sustainable use management ensures that renewable resources remain available to future generations. The criterion for sustainable use is that the resource not be harvested, extracted or utilized in excess of the amount which can be produced or regenerated over the same time period. In essence, the resource is seen as a capital investment with an annual yield; it is therefore the yield that is utilized and not the capital investment which is the resource base. By sustaining the resource base, annual yields are assured in perpetuity.

The difficulty of sustainable use management, or conservation, of coastal resources rises year by year because of increases in coastal populations, desire for short term foreign exchange earnings, the availability of technology, and so forth. Restrictive allocation of the resources of the coastal commons tends to come only after excessive exploitation causes serious depletion of resources and resulting shortages of food and materials or social conflicts. However, some coastal communities have solved this problem by traditional management mechanisms and consequently are ensured of sustained yields of seafood and other coastal products. ICZM-type programmes encourage the continuance of effective traditional management systems operated at the local level (see Principle 14).

In summary, ICZM programmes are founded on the proposition that renewable resource systems must be managed to provide a sustainable level of output.

5.12 Principle 12: Multiple-use management is appropriate for most coastal resource systems

Exclusive use of a particular coastal resource unit for a single economic purpose is discouraged by ICZM in favour of a balance of multiple uses whereby economic and social benefits are maximized, and conservation and development become compatible goals.

Contrary to some current impressions, conservation and economic development are not conflicting ideas. In fact, well-planned conservation-oriented development will add to the general economic and social prosperity of a coastal community, while bad development will sooner or later have a negative effect.

The simultaneous achievement of development goals and resource conservation goals may require that communities modify development patterns. However, with innovative management based upon sustainable use, communities may be able to achieve a desirable balance without serious sacrifice to either short term development progress or longer term conservation needs.

As planners sort out the problems, opportunities, and issues of the coastal area, those which most naturally fall under an ICZM programme become obvious. The tableau will vary from country to country according to conservation needs, traditions, norms, and governmental systems. But compatible multiple-use objectives should always be encouraged with the goal of strengthening the programme, improving its efficiency, and guaranteeing the greatest benefit to coastal communities through equitable sharing of resources.

According to Burbridge (1986), factors such as the potential utility of the goods and services, manpower, and market forces play a significant role in the way natural systems are used. The potential benefits that complex resource systems, such as estuaries and mangrove forests, offer to social and economic development depend on maintenance of the functional integrity of these natural systems. They should be developed for a broad spectrum of sustainable multiple uses, not converted to any single purpose use. The multiplicity of benefits these natural systems offer is often overlooked because most development plans for coastal areas focus upon maximizing single purpose uses. The management systems usually created are too narrow and generally fail to harness much of the resource potential offered by natural systems. As a result, many opportunities for the improvement of economic and social welfare of coastal people are not realized.

A very basic problem in many countries is that responsibility for complex natural resource systems is given to agencies which represent only one economic sector. For example, because mangroves are trees, mangrove forests are often made the responsibility of a Ministry of Forestry. While alert foresters may become aware of the value of mangroves in controlling coastal erosion and the importance of mangroves to the conservation of fisheries, their primary responsibility is to develop mangrove forests for wood production. They are, therefore, not normally asked to conduct broadly based environmental and economic assessments of mangrove systems or to develop management plans for sustainable uses other than forestry (Burbridge, 1986).

In economic terms, the multiple-use concept requires that all actual and potential uses for resource utilization schemes be determined so as to ensure that the sum of the "opportunity costs" is minimal. Opportunity costs represent the value of those lost options (or opportunities) that would otherwise be derived from using other resources, as opposed to committing one resource for an exclusive use. For example, in determining the allocations of fresh water for either irrigation or fishery maintenance, if the use of fresh water is exclusively for irrigation, then this imposes an opportunity cost for fisheries which equals the annual income which could have been obtained but is now lost due to its collapse (e.g., the Egyptian sardine fishery in the Mediterranean and the hilsa fishery in Pakistan). A major advantage in a balanced multiple-use programme for a coastal resource is that investment risk is lowered. The multiplicity of uses provides a hedge against failure of any one use of a resource and enables flexibility in face of unexpected change in the market or natural variation in the productivity of the resource.

In summary, the maximum flow of natural goods and services from a coastal resource system can be expected in a multiple-use ICZM approach.

5.13 Principle 13. Multiple-sector involvement is essential to sustainable use of coastal resources

A major purpose of ICZM is to coordinate the initiatives of the various coastal economic sectors toward long-term optimal socio-economic outcomes, including resolution of use conflicts and beneficial trade-off. This integrated, multiple-sector approach is designed to interrelate and jointly guide the activities of two or more economic sectors in planning and management. This supports a programmatic goal to optimize resource conservation, public use, and economic development.

International assistance agencies commonly use the term "sectoral" planning, or management, to describe these activities within a particular economic sector or development area. Some of the more common sectors are: agriculture, forestry, fisheries, energy, transportation, manufacturing, tourism, housing, military, and public health. Any of these sectoral areas can be further divided into more specialized coastal components; for example, transportation may be divided into shipping, ports, and surface transportation (Sorensen and McCreary, 1990). A further sector to be considered is the public, or social, sector, including the various publics who are affected by private and government decisions.

Almost every sector has a strong stake in the coastal area. It would be virtually impossible to allocate the coast to a single one of these economic sectors for development, or even to give one or two sectors a priority for coastal development. In fact, it is the intense conflict over use of the coast that so often arises among the various sectors that makes the ICZM process so necessary. A major goal of ICZM is to identify conflicts over coastal land and coastal renewable resources and to find ways to allocate and manage uses for the optimum long-term benefit of the nation in a multiple-use format.

Coastal natural hazards are usually addressed in sectoral plans for public health and safety. But natural disasters cut across all coastal dependent economic sectors. Wind damage from a hurricane, inundation by a tsunami, or rapid coastal erosion can affect tourism, the fishing industry, port operations, public works, and transportation. Other sectors such as housing and industry are also vulnerable. The potentially devastating consequences of development in coastal hazard prone areas, necessitate the use of integrated coastal planning (Sorensen and McCreary, 1990).

Whenever possible, the public sector (the general public of the community) should be consulted about any major coastal development. According to Renard (1986), public participation is a tool available to the entire management community (resource users, public agencies, non-governmental organizations, etc.) to ensure the quality and the effectiveness of the management solutions that will be implemented. Participation is also a duty because the issue remains, above all, one of human development, and because "...people are not the object of that development but the subject of development and the makers of their own history".

5.14 Principle 14: Traditional resource management should be respected

Local communities that have exclusive rights to their adjacent marine resources have typically evolved effective conservation programmes. Recently, the potential of "traditional" conservation approaches (customary fishing rights, marine tenure, etc.) has been increasingly explored. Johannes (1982) explains as follows:

> .."Throughout most of Oceania the right to fish in a particular area was controlled by a clan, chief or family. Generally this control extended from mangrove swamps and shorelines across reef flats and lagoons to the outer reef slope. It would be difficult to overemphasize the importance of some form of limited entry such as this to sound fisheries management. Without some control on fishing rights, fishermen have little incentive not to overfish since they cannot prevent others catching what they leave behind. This is a central tenet of fisheries management science. Under modern conditions the government must assume the sole responsibility for placing and enforcing fisheries conservation measures. This is a difficult and expensive responsibility under the best of circumstances; it is close to impossible in most tropical artisanal fisheries"...

A corollary to the above is that the incentive to protect the resource base - physical habitats and water quality - is stronger where access to the area is limited to traditional users who still maintain control. Thus, in countries where customary fishing rights are maintained, serious consideration should be given to the maintenance of these rights. However, as Johannes points out: "It would be a mistake to romanticize traditional island fishermen, to view them as ideal conservationists living in perfect harmony in nature and one another."

Consequently, ICZM should recognize that often the most socially desirable and efficient approach to resource management is allocation according to traditional approaches worked out for specific cultures in specific coastal locations over hundreds or thousands of years. The yields obtained from coral reefs and lagoon fisheries in Oceania, acadjas in West Africa, vallicoltura in the Venice region, "fish crawls" on the Mediterranean and Atlantic coasts, and small-scale traditional fisheries all over the world, have been maintained over centuries.

There is a striking similarity among the successful traditional methods of management and conservation of coastal systems that have been devised by the peoples of very different origins and cultures (Ruddle and Johannes, 1985). This commonality of success demands attention to the needs for continuation of traditional methods through ICZM where appropriate, particularly the protection of the community's rights to exclusive use of its traditional fishing areas.

In the coastal zone there have also been traditional (sometimes exclusive) rights to the use of certain lowlands and mangrove areas and these will be of major socio-economic concern to the communities involved. When governments attempt to reassign these areas from communal to private use, the traditional users can be very disturbed, as they were in certain

islands of the Philippines when use of mangrove areas was transferred to private shrimp farmers.

5.15 Principle 15: The environmental impact assessment approach is essential to effective coastal management

Environmental assessment is a term used to describe both a governmental process and an analytical method. As a process, environmental assessment is usually imposed by government to require public agencies (and in some cases private developers) to predict environmental impacts, to coordinate aspects of planning, and to submit development proposals for review. As an analytic method, it is used to predict the effects of a project or a programme. According to Sorensen and McCreary (1990) three fundamental benefits arising from these objectives are that:

- cause and effect relationships can be determined with reasonable accuracy and presented in terms understandable by policy-makers;

- prediction of impacts will improve planning and decision making;

- the government can enforce decisions emanating from the environmental process.

The assessment process includes prediction of a proposed project's effects on renewable coastal resources as well as the potential effects on the quality of the human environment. The process when mandated by law or executive decree generally involves a procedure that requires the following information: 1) the characteristics of the project site; 2) description of the project; and 3) description of the environmental impacts of a project for different dimensions of the environment. Usually it is required that alternatives to the project be identified and comparatively assessed, and measures to avoid or mitigate impacts be spelled out (Sorensen and McCreary, 1990).

While impact assessment is usually focused on the project level, assessments may focus at the programme level, such as for a regional economic development initiative. Programme level impact assessment - when done for a large geographic area - is conceptually similar to regional planning but does not include a mechanism to compel actual plan making and implementation.

The assessment of the social impact of development is an important part of the environmental and economic evaluation process (Cohen, 1985). In the present context, social impact assessment (SIA) is a way of trying to measure what might happen to people, their institutions, and their communities as a result of a particular environmental change. It involves the use of social science techniques to make predictions and to evaluate outcomes.

6. STRATEGIC PLANNING

Because the special conditions of the coast have not always been understood and given due regard by programme designers, economic planners, project engineers, and international donors and banks, there have been losses of revenue, jobs, food, and foreign exchange earnings potential in many coastal countries that could have been avoided. ICZM programmes are designed to correct this situation.

ICZM is a powerful mechanism for allocation of natural resources based upon sound environmental and socio-economic planning and evaluation. It requires networking with all relevant government activity, including national economic development planning.

In this report two types of planning are discussed - strategic planning and master planning. Strategic planning is covered in this section and master plan preparation in the next.

As the initial step, strategic planning considers problems and opportunities regarding resources, economic development activities, and societal needs in the coastal area and devises a strategy to accomplish ICZM objectives. A major purpose of strategic planning is to devise a programme that will promote compatibility between economic development and the long term environmental and socio-economic needs of the community. But compatible multiple-use objectives should always be the main focus and the strategic plan should establish a method to eschew short-term development tactics in favour of long-term development and resource conservation strategies.

Planners know that the best of plans often remain on bookshelves and are not put into practice, usually because of a lack of political commitment to the socio-economic changes the plan would require. It is much easier for decision-makers to authorize a planning initiative than to implement its provisions. Therefore, the maximum of commitment to the planning outcome should be secured from decision-makers at the beginning.

6.1 The Challenge

For professional planners, understanding the benefits and mechanisms of ICZM-type programmes should be easy, as mentioned previously. On one hand, ICZM programmes are distinctive because the coast is a landform with such different resources and unique problems. On the other hand, the ICZM process of programme development is a familiar one. Regional economic development planners and resource planners, particularly, should feel comfortable with ICZM because it deals with designated areas, the variety of resources and economic sectors therein, and other compatible subjects.

In addition to control of development, ICZM has to consider the protection of environmental values. Environmental protection enters into the management equation as including the important, but less tangible, values of nature protection and biodiversity conservation. Their inclusion in an ICZM programme could be controversial because many countries tend to give the priority to tangible yields, products, and consumption. Yet there is a general global awakening to the need for environmental maintenance together with changes in national accounting procedures.

It is important to recognize that ICZM is oriented more toward management of development than to management of resources. The example of fisheries will illustrate the difference. In most countries there is a department of fisheries which has responsibility for the management of coastal and marine fish stocks (as common property resources). This department implements conservation by prescribing closed areas for fishing, closed seasons for certain species, prohibitions on certain methods of fishing, and other controls. ICZM does not usually pre-empt this resource management role. Instead, it supplements and enhances the work of the fisheries managers by controlling coastal development and resource uses (such as pollution discharge or coral mining) which conflict with fisheries and which could have an adverse impact on fish stocks and particularly on the critical habitats which provide life support for fish species. In fact, some State ICZM programmes in the USA explicitly separate development management from resources management.

6.2 The Role of Strategic Planning

The strategy plan lays the foundation for the legislation or the executive order that is needed to authorize the ICZM programme (the programme development stage follows). The plan should: 1) assign responsibility for the programme to a particular agency; 2) authorize the funding necessary for programme development; 3) state clearly the objectives of the ICZM programme; 4) recommend a method for collaboration among the various sectoral agencies and private interests involved; 5) state the time limits involved for various stages of programme development; and 6) require a specific programme development, or tactical planning and organizing process.

Every country evaluating the potential of an ICZM-type programme will have its own special approach to conservation of resources and will be facing its own distinct array of coastal issues. Nevertheless, the first priority has to be putting ICZM on the country's political agenda and obtaining favourable action on a mandate for conservation. The programme content will vary from country to country according to needs, traditions, norms, and governmental systems (see Box 6.1).

According to Chua Thia-Eng (pers. comm.), a considerable amount of groundwork has to be done in any country to build up public awareness and political climate in favour of any attempt at environmental management for attaining sustainable development. In developing countries, the availability of outside funding is often a key factor in building awareness. After awareness and political sensitizing, strategic planning comes in, followed by policy formulation and programme development.

6.3 Strategic Planning as the Second Programme Stage

While each country's programme will be unique, there are several basic stages in the generation of an ICZM programme which should be common to most, in one form or another. These stages are as follows:

1. Policy Formulation: Creation of an initial policy framework to establish goals and to authorize and guide the ICZM programme; accomplished by executive and/or legislative action. This stage includes authorization for strategic planning.

BOX 6.1 - ASPECTS OF POLICY AND PLANNING FOR COASTAL AREA MANAGEMENT AND PLANNING (CAMP)

Different branches of government are responsible for different aspects of marine affairs. One branch of government may be responsible for fisheries, another for tourism, yet another for transportation. Planning and environmental issues are often the concerns of still other departments. While all of these branches of government are ultimately concerned with economic and social development, they can unwittingly impede development of other sectors and create conflicts of usage from fragmentation and lack of communication. Often apparent conflicts can be easily resolved and with careful planning the resource base can sustain multiple usages. By taking an integrated approach, development potential of all sectors can be maximized, conflict minimized, and the resources protected. This usually requires a reassessment of policy.

Arriving at a realistic policy for marine resource management requires that this re-evaluation be a shared effort among the resource management community. Naturally this means the various groups involved must compromise, since their individual goals will be quite diverse. But a major purpose of the multi-disciplinary, participatory approach is to foster compromise and cooperation in the community. If the effort is successful, what will emerge is a policy that is rooted in local dynamics, and the options chosen are ones that can actually work for the community as a whole. Other more tangible factors also have to be included in policy determination.

Successful policy must be based on solid biological and socio-economic and socio-cultural information.

The purpose of management planning is to achieve a desired situation, and the direction that management policy takes is dependent upon the desires of government and resource users and consumers. These desires are synthesized into an ideal that becomes the **goal** of management policy. While not realizable, this ideal provides direction. **Objectives** are specific outputs necessary for progress towards a goal. Objectives generally are obtainable, and are used to determine what actions need to be taken. Objectives should always be based on solid biological and social data.

Goals and objectives serve two important purposes in management planning: they are the foundation for determining management policy, and they are the standards by which to judge success.

Source: *Adapted from Geoghegan (1984)*

2. Strategic Planning: Sometimes called "Preliminary Planning", this is the stage where the feasibility and potential impacts of the ICZM policy action are explored. Impacts may affect resources and resource users; income, foreign exchange, and jobs; and social and cultural well-being. This planning stage is where benefits are evaluated, where a wide array of data is accumulated, where a general strategy is created, and where recommendations are made for implementing policy and organization and administration of the ICZM programme.

3. Programme Development: In this stage the ICZM programme is developed in detail, a Master Plan for the coast is prepared, institutional mechanisms are created, and programme responsibilities are assigned. Revisions will usually be necessary during the process.

4. Implementation: Once the Master Plan and programme details are approved and a budget and staff are authorized, programme implementation can commence.

In practice, the above stages are not so discrete and linear as theory suggests. Instead, there will be feedbacks and revisions of earlier stages as new facts and opportunities come to light in later stages. For example, there will certainly be the need for policy revision and strengthening as a result of findings and recommendations from stages two and three. Therefore, the whole programme must be flexible and adaptable (Figure 6.1).

6.4 Policy Formulation

No ICZM-type programme can be stronger than its policy foundations. Clear and specific goals and directives are essential. In Box 6.2 examples of the type of goals and strategies appropriate to ICZM-type programmes are listed; of course, not all of these goals would be found in every country's programme.

ICZM will discourage piecemeal approaches to coastal development in favour of a balance between a variety of compatible uses whereby economic and social benefits are maximized and conservation and development become compatible goals. Moreover, certain resource reserves, critical habitats, and other specially designated areas might be set aside for restricted use. Chua Thia-Eng (pers. comm.) makes the points that: 1) the primary function of ICZM is environmental management, which it does through special forms of management of development and of resources; and 2) ICZM planning may result in shifts in general economic policy of a country.

Regarding national economic development, ICZM should closely reflect general governmental economic policy. In so doing, ICZM programme policy might incorporate the following concepts, among others: optimize the long term economic benefits to society from the marine area under national jurisdiction; decrease economic dependence on advanced countries; decrease the influence of private developers in controlling the pace of economic growth (by default) and determine the parameters for government decision-making; clarify

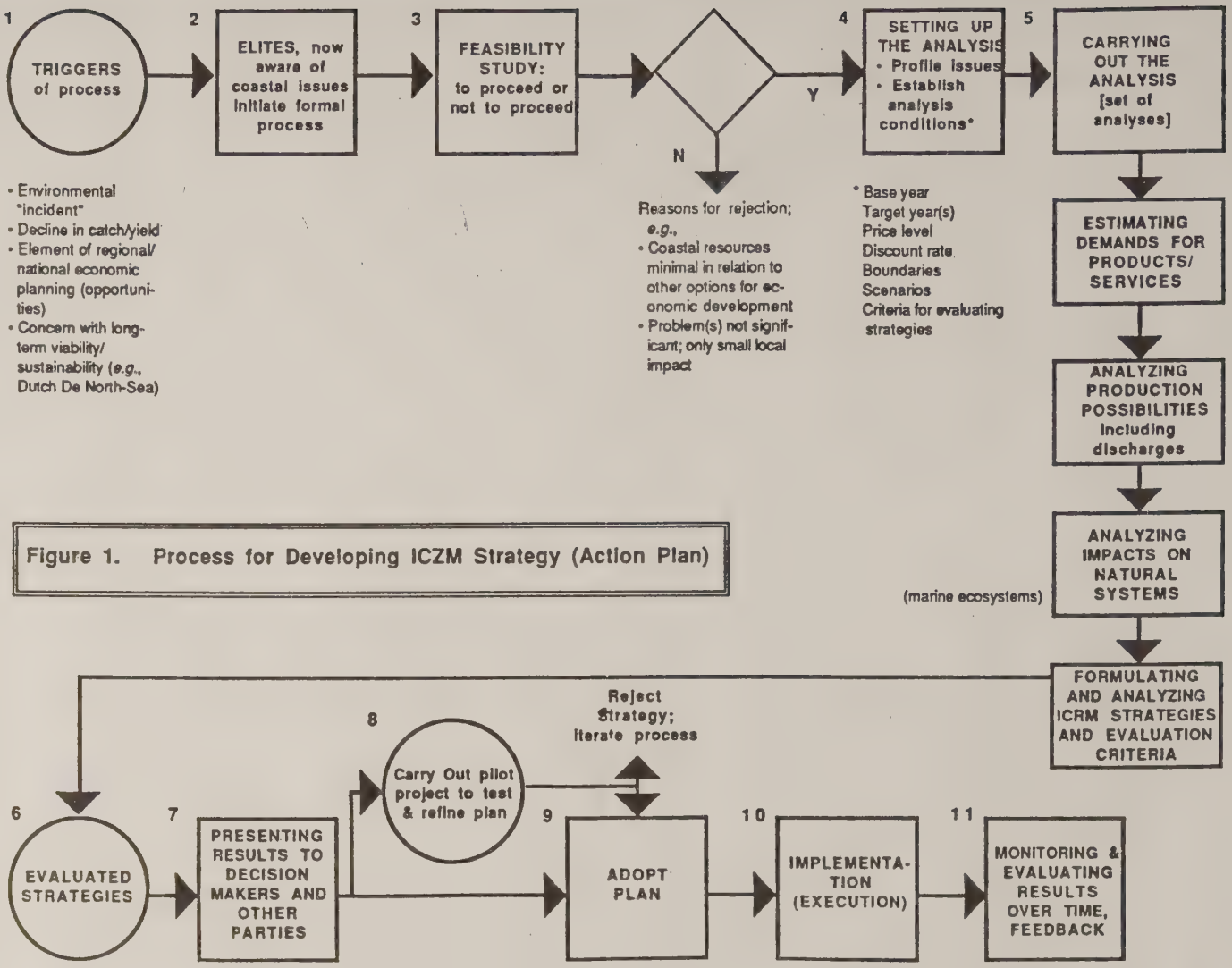


Figure 1. Process for Developing ICZM Strategy (Action Plan)

Figure 6.1 ICZM Process: Strategy Planning (Steps 1-6) and Programme Planning (Steps 7-11)
Source: Clark (1991c)

BOX 6.2 - EXAMPLES OF ICZM GOALS AND STRATEGIES

Maintain A High Quality Coastal Environment: The coast is a major national resource, providing commerce, food, recreation, spiritual refreshment, and security. These values will not last forever without conservation. ICZM would provide the means for maintaining the quality of the coastal environment.

Protect Valuable Species: Many coastal species need special protection. ICZM would preserve their breeding and feeding areas through protected reserves and the use of regulations.

Conserve Critical Coastal Habitats: Habitats of special importance to species and the functioning of coastal ecosystems - mangroves, seagrass meadows, coral reefs, beaches, lagoons, and certain tideflats - would be protected in ICZM programmes.

Conserve Critical Ecological Process: Certain ecological processes are critical - supply of nutrients, penetration of light through the water (avoid excessive silt and turbidity) and water circulation - and need protection through regulations.

Control Pollution: Pollution from point sources and from land runoff as well as accidental spills of pollutants which foul coastal waters (human health problems and ecological disruption) would be addressed by ICZM programmes.

Provide Development Guidance: Much of the ecological and scenic disruption of the coast is from inadvertent side effects of coastal development. An ICZM programme would provide advisory services to development entities to help them reduce impacts.

Provide Planning Guidance: To avoid development initiatives which would be damaging to the coast, advice would be provided to various planning entities - physical planners, economic planners, development planners - through ICZM. Of particular importance is infrastructure; highways should be properly routed and water and power not provided to sensitive places.

Identify Critical Lands: Certain areas of the coast have a special potential for recreation, housing, nature protection, economic development, and so forth. The ICZM programme would identify lands optimum for development and for nature.

Restore Damaged Ecosystems: Many otherwise productive coastal habitats have been damaged but are restorable. The ICZM programme would offer opportunities to identify and restore such habitats.

Public Awareness: ICZM can play an important role in creating public awareness of coastal values and needs for conservation.

for potential investors the intentions and objectives of the government; and guide development and use of the country's marine area in a rational and efficient manner for highest and most equitable economic benefit to the people.

A national policy is a fundamental requirement for the development and use of maritime (high seas) resources and for special management of enclosed seas. Such a policy establishes goals, objectives and priorities and lays down basic principles and criteria which provide guidance for the formulation of plans and programmes and a marine development strategy. The policy should outline a framework that identifies the financial, human, technical and institutional resources needed.

Broad participation of the citizenry should be encouraged. Therefore, beginning with policy formulation and continuing through each subsequent stage of development of the programme, interested citizen groups should be frequently consulted (see Principle 10). Renard (1986) identifies the following broad themes as examples of those that should be addressed:

- Determination of economic, social, political and cultural situations;
- Respect and support for the culture;
- Dialogue, sharing of agendas and mobilization (not "confidence building"), ability to listen;
- Intervention based on the human system as well as on the natural system - multidisciplinary and multisectoral approaches;
- Participatory research, use of folk knowledge and permanent redistribution;
- Collective problem identification - formal and informal activities;
- Formulation of solutions and promotion of consensus; and
- Utilization of indigenous technology, know-how and experience.

6.5 Preparing the Policy Statement

The policy statement should declare in the strongest terms possible that it is the intention of the nation to review and exercise control over developmental activities affecting the sustainability of coastal renewable resources (Goeghegan, 1984). The goal should be maintenance of the optimum sustainable use of coastal renewable natural resources, in both the economic and social context. The policy should then list specific national coastal concerns and issues to be addressed and state the priorities of the nation toward coastal resources conservation.

The policy statement should also state the actions that the executive authority or legislative body expects various agencies of government to take. In addition to specific assignments to agencies for the strategic planning stage to follow, there should be assurance that funds are authorized and available to pay for the work that must be done.

In policy formulation, it is not appropriate to identify particular programme details because policy is concerned with general goals and directives. In fact, specifics should be avoided because it is too early in the process to make informed decisions about precise programme components or objectives. There is danger in becoming locked into specifics that may prove to be misdirected.

In many countries a considerable amount of policy affecting coastal renewable resources will already be in existence. Therefore, an evaluation of existing policy is a first step. Creation of new policy to fill gaps and integrate existing policy is a second step. The Philippines is an example of a country where considerable policy and operational legislation has been enacted which altogether gives a sufficient policy base for an integrated ICZM programme (although it has not been implemented to date). Examples of the policy instruments developed by the Philippines are given in Box 6.3.

Coastal development policy should emphasize that it is in the best interests of the country to achieve sustainability of its resources and long-term protection of its natural assets. To this end the set of goals suggested for a proposed Saudi Arabian ICZM programme for the Red Sea (as listed in Box 6.2) is worth reviewing (adapted from Clark, 1985).

6.6 The Strategic Planning Process

This stage involves all the preliminary investigation, data collection, dialogue, negotiation, and draft writing that is necessary to enable the government to define the problems, to understand its options and to proceed to authorize a specific ICZM programme.

The strategic plan lays the foundation for the legislation or the executive order that is needed to authorize the Programme Development stage that follows. The strategic plan should: 1) specifically assign responsibility for the programme to a particular agency; 2) authorize the funding necessary for programme development; 3) state clearly the objectives of the ICZM programme; 4) recommend a method for collaboration among the various sectoral agencies and private interests involved; 5) state the time limits involved for various stages of programme development; and 6) require a specific step-by-step programme development and organizing process.

To create the strategic plan for an ICZM programme requires consultation with a wide array of interests, both governmental and private. It is the accepted wisdom of ICZM experts that only a truly integrated programme (i.e., one that includes all the major economic sectors affected) can succeed fully. If important stakeholders are left out - e.g., tribal chiefs, port authorities, housing departments, tourist industries, fishermen, economic development planners - ICZM will likely fail. Figure 6.2 depicts the complexities that face strategic planning - numerous sectors are involved and strong political and economic pressures come into play.

National development decisions have typically targeted single sectors and reflected too little concern about the impact these narrow decisions may cause on other sectors. The more common sectors of commercial activity are: agriculture, forestry, fisheries, energy, transportation, manufacturing, tourism, housing, environmental protection, military, and public health. Any of these sectoral areas can be further divided into more specialized coastal components; for example, transportation may be divided into shipping, ports, and surface and air transportation.

BOX 6.3 - EXAMPLE OF PHILIPPINE COASTAL POLICIES

A general policy statement formulated by the Inter-agency Legal Committee of the Natural Environmental Protection Council for organizing an ICZM-type programme states: It is hereby declared a policy of the State to pursue a continuing programme of effective management of coastal zones to meet the socio-economic development needs of our country for the benefit of present and future generations. In pursuing this policy, it shall be the responsibility of all government bureaus, agencies or instrumentalities, including political subdivisions involved in coastal management, to instill awareness to the public about the dangers of the degradation of environmental conditions in the country's coastal zones and encourage active participation of the people in all undertakings to conserve and enhance the country's coastal zones.

Section 26 of Presidential Decree No. 1152 (Philippine Environmental Code) states that the national government, through the Department of Natural Resources (now the Ministry of Natural Resources), shall establish a system of rational exploitation of fisheries and aquatic resources within the Philippine territory and shall encourage citizen participation therein to maintain and/or enhance the optimum and continuous productivity of the same.

Section 27 of Presidential Decree No. 1152 provides for the measures for the rational exploitation of fisheries and other aquatic resources which include, but shall not be limited to: a) undertaking manpower and expertise development; b) acquiring the necessary facilities and equipment; c) regulating the marketing of threatened species of fish and other aquatic resources; d) reviewing all existing rules and regulations on the exploitation of fisheries and aquatic resources, with a view of formulating guidelines for the systematic and effective enforcement thereof; and e) the conserving of the vanishing species of fish and aquatic resources, such as turtles, sea snakes, crocodiles, and corals, as well as maintaining the mangrove areas, marshes and inland waters, coral reef areas and islands serving as sanctuaries for fish and other aquatic life.

***Source**: NEPC (1983); Tolentino (1984)*

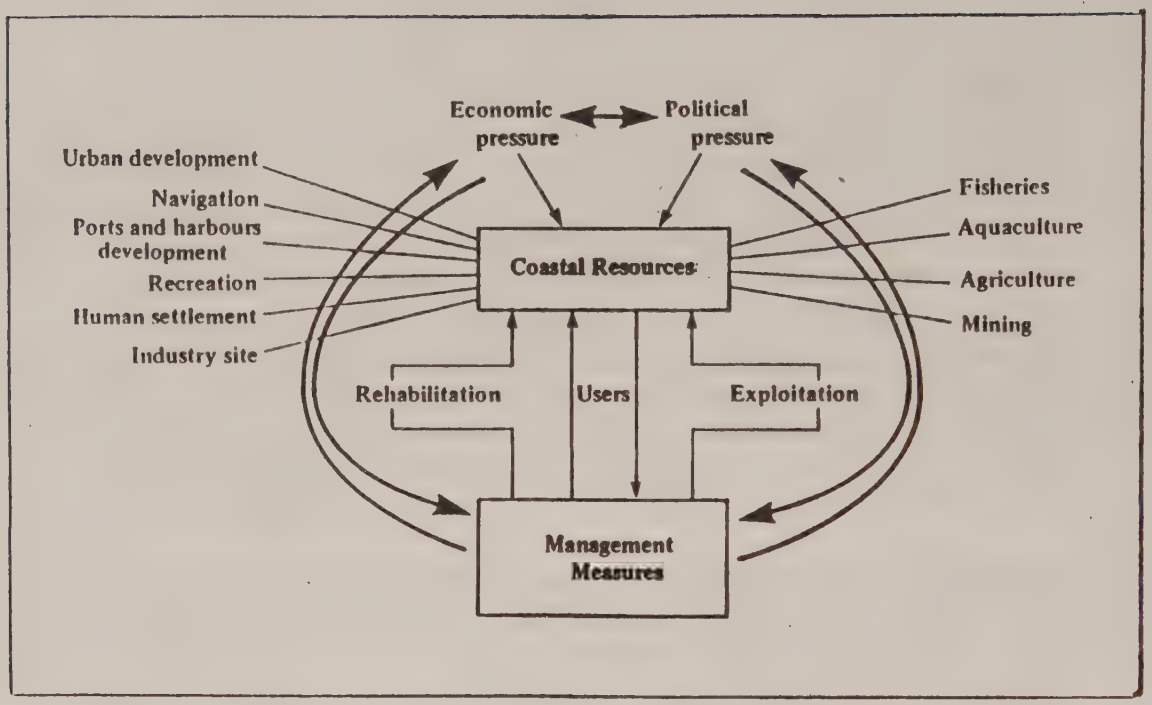


Figure 6.2 ***Forces at work on coastal resources include a variety of economic sectors and political powers, each with a stake in levels of exploitation. Creation of management measures to control exploitation and rehabilitation of coastal resources are the role of ICZM programmes. Source: Chua (1986)***

The sectors, each with its own clientele, compete for funding, resources and political advantage. Therefore, at the planning or budget level, the inputs of different sectors may conflict and pull in different directions. For this reason, special arrangements are needed to guarantee a multi-sectoral, integrated, approach. For example, the organization of a coastal programme to manage mangrove forests for the sole benefit of the fisheries sector might succeed, but more likely it would fail if it lacks mechanisms to incorporate the interests of local villagers, forest industries, upland agriculture, public health, tourism, port development, and so forth (Table 6.1).

It is unlikely that the sectors themselves would cooperate with each other to reduce misuse of coastal resources in the absence of government intervention. Therefore, the ICZM programme should be organized so as to encourage and guide intersectoral cooperation and activity coordination in order to achieve the goal of an integrated, multi-sectoral plan.

Table 6.1 Typical Economic Sectors of Coastal Countries
Source: Sorensen and McCreary (1990)

Sectors that are often coastal zone or ocean specific	Sectors that are rarely coastal zone specific but have direct impacts
1. Navy and other national defense operations (e.g., testing, coastguard, customs	1. Agriculture - Mariculture
2. Port and harbour development (including shipping channels)	2. Forestry
3. Shipping and navigation	3. Fish and wildlife management
4. Recreational boating and harbours	4. Parks and recreation
5. Commercial and recreational fishing	5. Education
6. Mariculture	6. Public health - mosquito control and food
7. Tourism	7. Housing
8. Marine and coastal research	8. Water pollution control
9. Shoreline erosion control	9. Water supply
	10. Transportation
	11. Flood control
	12. Oil and gas development
	13. Mining
	14. Industrial development
	15. Energy generation

6.7 Institutions and Jurisdiction

It is a major objective of ICZM to facilitate coordination among levels of government and their various bureaucracies toward defining specific resource conservation goals. This may require realignment of institutional arrangements at various levels of government. The very fact that an ICZM programme is being considered for a country suggests that in the past adequate attention has not been given to conservation of coastal renewable resources.

There is no single answer to the question: "Where should the ICZM authority be lodged within the government institutional structure?" The correct answer will be different for each country depending upon answers to other questions, such as: Would a coordinating office be sufficient? If so, within what ministry should the office be lodged? Or would an agency with power to act independently be needed? What kind of staff skills are necessary? How would such an agency integrate the roles of the several sectorally oriented agencies with strong interests in the coast? These are crucial points that must be addressed. An ICZM agency must be part of, or have influence over, economic development sectors. A central coastal office may be realistic only if its functions are non-competing and its main role is coordinative.

It may be useful to designate a particular Ministry for the strategic planning phase and another for implementation, including programme development and management.

The mutuality of interest suggests that in some countries, agencies responsible for prevention and mitigation of natural hazards should become equally as interested in advancing ICZM programmes as are the agencies responsible for resource conservation and environmental protection. Because officials responsible for coastal hazards concern themselves mostly with emergency response and post-disaster relief, the condition of the coast's protective resources has been too often ignored. That is why it is essential for ICZM to undertake a primary role in prevention. Also, conservation of the physical natural defenses of the coast is a logical counterpart to conservation of natural habitats.

It is certain that ICZM must be integrative, allowing for multiple uses and not be pre-emptive. Its role is to make judgements about development and resources management that are for the benefit of the nation as a whole and not for the good of a particular economic sector or agency of government. ICZM is committed to advancing sustainable multiple use of coastal resources (Principles 11 and 12) through an integrative, multiple sector approach (Principle 13).

In the ICZM process, legislation and administrative arrangements should be as flexible and cost-effective as possible and should adhere to simple guidelines such as the following proposed for marine protected area programmes (Salm and Clark, 1984):

- New agencies should be created only where existing agencies cannot be adapted, motivated, and empowered to carry out adequately the task.

- Existing agencies with jurisdiction over marine activities should be involved by interagency agreement as necessary and appropriate to meet the conservation objectives.

- Existing regulations and regulatory mechanisms should be continued when they are consistent with conservation objectives.

- Regulations and management plans should be as simple as possible.

Central government jurisdiction in developing countries often begins at the low-water mark and extends seaward, whereas regional and local jurisdiction extends landward from the low-water mark. This can have a significant effect on ocean use, since all ocean uses require companion land-based support facilities. Accordingly, the development and regulation of the coastal lands needed for land-based support systems may be under the control of the local or regional government whereas the actual use and development of the marine environment will be controlled by the national government. Problems may result if local governments perceive national policies for development of the marine area under national jurisdiction differently from the central government (UNESC, 1987).

6.8 Boundaries

ICZM is a management and planning programme for a specific situation, the coastal area, or coastal zone. Consequently, it is necessary to delineate the area of ICZM jurisdiction by specifically, and legally, defining the coastal zone (Principle 5). The boundaries should be based upon the issues to be addressed in the ICZM programme; i.e., the problems to be solved by ICZM exist within a certain area and this area can be defined as the coastal zone for either a nationwide programme or a regional (subnational) programme.

The boundaries of the coastal area (or "coastal zone") to be addressed in an ICZM-type programme depend upon the specific functions of the programme. All ICZM programmes include both land and water within their boundaries. There is not one standard set of prescribed ICZM boundaries.

Planning boundaries for the coastal area, or coastal zone, must be specified at the strategic planning stage. Initially a relatively broad planning zone should be delineated. Subsequenty, a narrower management zone should be delineated. It is important to recognize that ICZM programmes evolve through stages from initial planning to final management programme. The first set of boundaries are for the planning phase and do not imply that the entire coastal zone delineated for planning will be included in the management programme that evolves. In fact, the zone of management that emerges will in most cases be narrower than the initial zone of planning for ICZM. One purpose of the planning phase is to refine the boundaries and reduce the width of the designated coastal zone to the minimum needed for the management phase.

The ICZM zone defined for planning should also include the areas most threatened by seastorms, tsunamis, and certain other natural hazards. Thus, to the extent possible, ICZM planning boundaries should be functional boundaries, encompassing natural ecosystems and natural forces. But at the same time they should reflect the boundaries of towns and industrial centres; that is, where possible the boundaries should be modified to include an entire community.

In a broad context, the coastal zone could be as wide as 300 km or more if it were designated to include the entire EEZ (200 miles or 320 km wide), transitional areas, and

adjacent uplands. The EEZ is important to small countries because it vastly increases their area of economic influence - for example, from 70 to nearly 500 000 square miles in the case of the Marshall Islands in the South Pacific. Countries that cannot themselves exploit the vast EEZ can "rent" it to other nations for fishing or other uses. The role of ICZM in this process would be minimal in most countries but should be explored in detail for certain countries.

Small island countries may have a particularly difficult time in determining ICZM boundaries. Some ICZM authorities would call entire islands "coastal zones" because most island commerce and societal affairs have a coastal connection. However, giving ICZM authority over the whole of an island seems unrealistic for a coastal programme, even though many island specialists recommend it.

Calling a whole island a coastal regime and abandoning the concept of a "coastal zone" as a definable and separable entity may jeopardize chances to achieve integrated resource management for the coast. To abandon the idea of governing a particular defined coastal zone or segment - an area - and instead to try to govern the use of the resources of the country at large, would result in a programme that lacks focus and distinctiveness, and particularly, cohesiveness. The strong political support needed to initiate an effective programme may dissolve. The narrower the coastal zone or coastal area, the more authority ICZM can expect to gain. The broader it is, particularly a whole country, the less authority it can gain because of the appearance of duplication and competition with existing authorities as well as the vagueness of function. Therefore, for islands, the author prefers to identify a coastal zone in the same manner as for other landforms.

Ideally, a coastal nation or subnational unit should set the boundaries of the ICZM zone only as far inland and seaward as necessary to achieve the objectives of the management programme. Since the problems and opportunities that motivate the creation of an ICZM programme vary considerably from one unit of government to another, the selection of boundaries would also be expected to exhibit considerable variation among coastal nations as well as among subnational units (Sorensen and McCreary, 1990).

For the inland boundary of the planning area, it will be convenient to use a major highway paralleling the coast, the foot of a coastal mountain range, or the inland boundary lines of the coastal counties or municipalities, or other recognized political or physical feature. This will be more practical than an arbitrary distance of 100 m, 1 km, etc., as is done by some US States (e.g., Washington and Connecticut). This "practical" type of planning area boundary is most convenient for regional planning and social demographic and economic analysis as well as for defining interest groups.

6.9 Planning the Form of the Programme

An ICZM programme can be designed to fit into any governmental structure. The variety of institutional arrangements is sufficiently flexible to match whatever administrative system a country has.

All ICZM programmes require three components as a minimum: 1) legal, policy and administrative structure, 2) a project review mechanism, and 3) a coordinative system.

Elaborations can be added as appropriate, including technical assistance, planning, inspection, extension services, public education, research, regional (subnational) programmes, protection of critical habitat areas, survey and mapping, habitat restoration, training, and so forth.

To be successful the ICZM programme requires specific kinds of support from government; particularly important needs are:

1. Clearly articulated policies for the development of coastal resources to fulfil national development objectives;

2. Clear assignment of responsibilities and designation of a lead agency to formulate and coordinate the programme;

3. Powers to enforce rules and to achieve intergovernmental coordination;

4. Funds to implement ICZM.

The particular form of any ICZM programme will depend upon the national and regional issues it is meant to address. Since the tableau of issues and options varies from country to country, so will the form of the programme. No two countries would be expected to have identical programmes. But the essential purpose remains the same - to create an interagency mechanism to promote sustainable uses of renewable resources within the defined coastal area.

Some of the most destructinve "development" practices - massive coral reef mining or mangrove forest cutting - will usually have to be curtailed because they are not sustainable and conflict strongly with other economic uses such as fishing and tourism. On the other hand, development activities with a lesser potential for damage can be adjusted in location, design or scale in order to meet guidelines (Table 6.2).

The realities of political, economic and social life of the particular country may require a less ambitious, more restrictive, beginning. An example of a limited programme is: a targeted management programme on shore erosion or perhaps on designating critical habitats. Such targeted programmes might later evolve into more full-scale regional ICZM-type programmes, as is occurring in Sri Lanka (Ogden and Gladfelter, 1983) where ICZM started with an erosion issue and now is expanding into a broader programme.

6.10 Use of the Strategic Plan

One way to think of the strategic plan is that its purpose is to answer questions in the minds of decision-makers in government. The answers will lead to decisions to authorize or not to authorize the ICZM programme or more fact-finding. To this end, the strategic planning stage should be organized to anticipate the questions that decision-makers will ask and to provide the data to answer these questions. Examples are given in Box 6.4. Chua Thia-Eng (pers. comm.) suggests that another key factor is attitudes and perceptions of affected communities toward expected changes resulting from management solutions.

Table 6.2 **Development Activities That Can Effect Selected Important Coastal Tropical Ecosystems. Source: Maragos (1983)**

Development Activity	Type of Ecosystem							
	Marshes	Deltas	Estuaries	Mangrove swamps	Seagrass beds	Coral reefs and lagoons	Beaches	Islands
Agriculture and farming		•	•	•	o	o		•
Feedlots, ranching and rangelands	o	o		•	o	•		•
Forestry		o		•				o
Aquaculture and mariculture	o	o	•	•	•	o		
Nearshore-catch fisheries		o	•	o	•	•		o
Dredging and filling	•	•	•	•	•	•	o	o
Airfields	o	o	o	o	•	•	•	•
Harbours	•	•	•	•	•	•	o	•
Roadways and causeways	o	•	•	•	•	•	o	o
Shipping		•	•	o	o	o	o	o
Electric power generation	o		•	o	•	•	o	o
Heavy industry (onshore)	o	•	•	•	•	•		•
Upland mining	o	•	•	o	•	•		o
Coastal mining	o	•	•	o	•	•	•	•
Offshore oil and gas development		o	o	•	•	•		•
Military facilities, training and testing	o				•	•		•
Land clearing and site preparation	o	o	o	o	o	•	•	•
Sanitary sewage discharges	o		•	o	o	•		•
Solid waste disposal	•	o	o	•			o	•
Water development and control	•	•	•	•				•
Shoreline management and use		o				•	•	•
Coastal resource uses	•	•	o	•	•	o	•	•

o Significant adverse effects likely
• Adverse effects possible

BOX 6.4 - QUESTIONS TO BE ADDRESSED IN STRATEGIC PLANNING

- Which coastal resources are seriously degraded; to what level have yields fallen; what are the economic consequences; what actions are needed to correct this situation?

- What are the causes of the degradation; what type of developments and activities need to be controlled; what are the economic effects of the controls; in consideration of the variety of possible trade-offs and their effects, what actions are recommended?

- Who are the principal users of coastal resources; how many jobs are at stake; how much income and foreign exchange earnings are involved. Fisheries and other resource dependent industries; what further losses are expected if ICZM is not implemented?

- What are the priority issues; what critical habitats and species need protection; what is the best approach, regulation or protected areas?

- What can an ICZM type programme do to prevent loss of life and property from coastal natural hazards such as sea storms and beach erosion; what are the benefits of combining hazards protection and resource conservation in a single coastal programme?

- What are the existing government programmes for coastal resources conservation at national and local levels; how effective are they; what are the shortfalls; what changes in governance are recommended?

- How effective are the existing mechanisms for interagency and intersectoral coordination on coastal matters; what can be done to improve the situation; what actions are recommended?

- What are the expected net benefits of an integrated national ICZM-type approach, in economic and social terms; how can an ICZM programme be funded?

- Who are the major proponents and opponents of the proposed ICZM programme?

- What is the status of personnel training for ICZM; is there sufficient expertise; what can be done to improve the situation?

To consider the more specific questions that are involved, it is useful to review, for example, the major objectives given in the ICZM strategic plan generated for the Sultanate of Oman by Salm (Salm, 1986, 1987):

- establishment of conservation areas
- management of recreational resources
- management of fisheries resources
- protection of cultural and archaeological resources
- maintenance of coastal aesthetic resources
- conservation of threatened wildlife resources, such as turtles and seabirds
- management of special environments, such as mangroves, coral reefs, sand dunes, beaches, lagoons, river valleys and flood plains
- proper design and construction of coastal developments such as harbours, marinas, seawalls, groins, piers, breakwaters, coastal roads and dams.

It is worth repeating that in most countries the goal should be to achieve the widest range of stakeholder participation possible at the Strategic Plan stage. Consultations should be held with all relevant agencies of central and local government, with private developers, with resource users and other interests that would be affected by ICZM (fishermen, farmers, etc.), environmental advocacy groups, and investment sources (including international donor institutions). These interests should be encouraged to go beyond dialogue and to participate to the maximum possible in goal setting, data collection, conflict identification and so forth.

Wide participation will improve the structure of the ICZM programme. It will also provide an opportunity to resolve conflicting points of view among powerful interests so that the Strategy Plan will meet the least political resistance as it goes through the approval process and so that the next phase, Programme Development, can proceed smoothly and not meet unexpected opposition.

6.11 Gaining Support for ICZM

The required clarity and specificity of ICZM programme elements can only be expected if the country's policy-makers are convinced of the value of ICZM and are willing to make a strong commitment. To achieve this optimum state may require a considerable political effort on the part of ICZM advocates. This effort must continue through the entire process; i.e., through all stages of development of the ICZM programme.

In convincing supervisors, decision makers, and legislators of the essentiality of an ICZM programme, nothing is more important than persuasive economic evidence. National income, foreign exchange earnings, employment and local self-sufficiency are most important factors (see Principle 10). These factors must be addressed during the policy formulation stage in a preliminary but convincing manner. Then in the strategic planning stage - which

is the principal opportunity for selling the ICZM programme - economic benefits must be addressed in a more detailed way. Because of the importance of economic justification of ICZM, it may be desirable to employ a professional resource economist to assist with the economic analysis.

It is most difficult to provide advice on how to effectively promote an ICZM programme because the art of politics is so specific to each country. But the advice of R. Knecht (1979), given in Box 6.5, should be of value to most countries. Chua Thia-Eng (pers. comm.) would add to this listing that a particularly dynamic approach to convince leadership about ICZM would be to emphasize "the socioeconomic benefits that are generated by the resource systems and the need to protect the continued functioning of those systems if sustained benefits are to be continued .... the resource system is the goose that lays the golden egg and should be protected".

The ICZM programme will be expedited and strengthened by broad consultation with the municipal and provincial governments most affected by the programme. Equally broad consultation with a variety of national government ministries will also pay off in greater cooperation and less opposition (see Principle 8).

It is also most important to have the support of, or at least the acquiescence of, the main resource users. Strong political opposition by fishermen or others who gain their living from marine resources could stall an ICZM programme.

Because the support and cooperation of numerous economic sectors is essential to the success of integrated, multi-sectoral programmes such as ICZM, it will be necessary in the policy formulation stage to consult with representatives (public and private) of the sectors that are likely to be most affected (see Principle 13). Many of these sectors will have little to gain from coastal resources conservation and they may see the ICZM programme as a problem rather than as an opportunity; examples are transportation, housing, military, agriculture, and manufacturing. To ensure a minimum of opposition from these sectors, strong persuasion may be needed along with assurance that the policies to be formulated will treat them fairly.

Sectoral fears can also be alleviated by stressing the multiple-use function of the ICZM programme in the policy statement (see Principle 12). Under ICZM most coastal areas would be open for a variety of compatible uses. Only certain resource reserves, critical habitats, and other specially designated areas would be set aside for restricted or single-purpose use.

6.12 The No-Programme Option

Many countries may not, in the end, choose to go to a full-scale, integrated, ICZM approach, but rather adopt a less sweeping programme with limited interventions. But, such countries are well advised to strive for the ICZM goals of comprehensive and integrated coastal resource management in their own approach. Chua Thia-Eng (pers. comm.) cites Singapore as a good example of excellent coastal planning "without the benefits of ICZM".

BOX 6.5 - CONVINCING YOUR NATIONAL GOVERNMENT OF THE MERITS OF CAMP OR COASTAL ZONE MANAGEMENT (CZM)

The following five points would be useful in discussing the merits of CZM with a national government:

1. Emphasizing the development aspects of coastal management as a positive approach.

2. The "balanced" nature of the coastal management approach should be emphasized. The emphasis in the programme also should be on management, that is, the prudent use and development of resources, and not on preservation per se. Of course, protection of sensitive coastal areas is a key objective of CZM.

3. Determine early who is potentially opposed to CZM and develop arguments particularly aimed at that sector.

   - Energy and industrial interests can be convinced that CZM will facilitate rational development and increase the predictability of the coastal situation.

   - Local authorities should realize that they can increase their impact on national government coastal policies through a partnership involving local CZM programmes.

   - Rival government agencies should be incorporated into the CZM planning process early on and made partners in the programme.

4. Clearly, one needs to argue the logic and reasonable-ness of rational coastal planning and management and obtain a maximum number of allies for this point of view.

5. Governments involved with planning for 200-mile Exclusive Economic Zones should understand the value of a foundation of rational coastal planning and management.

Source: Knecht (1979)

Not all countries need a formally constituted ICZM programme if ICZM can be incorporated in their existing institutional arrangements. With the development of ICZM as a recognized field, it has become a common perception that countries without a formalized ICZM programme cannot or do not manage their coastal resources in an integrated fashion. In some cases, however, it may be possible to achieve the same goals through an existing framework and infrastructure.

Where government departments and agencies responsible for different sectors of the coastal zone have the potential to collaborate and effectively coordinate their management activities, the result could be as well integrated as management carried out through a single ICZM programme, particularly where one agency takes the lead role. When this is possible, it is unnecessary to develop a new independent programme which could stretch limited financial and manpower resources even further, introduce a sense of competition, and be seen as a threat to existing institutions.

In some countries the result of the strategic planning stage will be to modify existing planning and resource management mechanisms to accommodate ICZM-type needs. For example, Trinidad and Tobago experimented with ICZM (starting in 1978) and conducted preliminary investigations of the potential for a regionalized approach. The country finally decided in 1984 that the established Town and County Planning Division could handle coastal development management with technical assistance from the Coastal Area Planning and Management Division of the Institute of Marine Affairs. According to McShine (1985): "It was decided that a separate Coastal Area Plan as distinct from an integrated National Physical Development Plan involving coastal development should not be formulated".

6.13 Priority Subjects for Strategic Planning

While strategic planning is not the detailed planning stage for the ICZM management programme which comes in the programme development stage, it lays the foundation for ICZM and it does provide to decision-makers, resource users, developers, and citizens, important information about the issues, conflicts, economic trade-offs and benefits, and potential working mechanisms of ICZM. This section describes some of the material inputs of value to the process.

6.13.1 Issues Analysis

It is essential to conduct a formal analysis of the significant issues facing coastal resources and coastal development at a very early stage of the programme. ICZM is an issue-driven process and the nature of the particular issues will dictate the type of programme to be created. Also, it is clear that the effort and expense of an ICZM-type programme would not be justified unless there were multiple issues of importance to address.

It is not enough to simply identify and list the issues. Each should be evaluated for at least the following: the extent of socio-economic disturbance and resource loss that it causes; the degree to which it could be resolved by an ICZM-type approach; and the consequences of not resolving it.

Sorensen and McCreary (1990) make the point that there should be a good fit between the set of issues an ICZM programme is attempting to resolve and the institutional mechanism set up in response. These authors also remark that the same issues that motivated a nation to create an ICZM programme are those that are likely to reappear as the criteria for programme evaluation.

6.13.2 Project Review

As has been stated many times, an essential element of an ICZM-type programme is a system to do a special review of major development projects that would impact coastal resources. Such a system would most usually be built around typical and well known "environmental assessment" techniques.

Environmental assessment (EA) is a term used to describe both a governmental process and an analytical method. As a process, environmental assessment is usually imposed by government on public agencies (and in some cases, private developers). The purpose is to predict environmental impacts and to coordinate aspects of planning (Gammon and McCreary, 1988; Thompson, 1985). EA programmes usually require that proposals for developments in excess of a certain magnitude be reviewed and approved before a permit can issue.

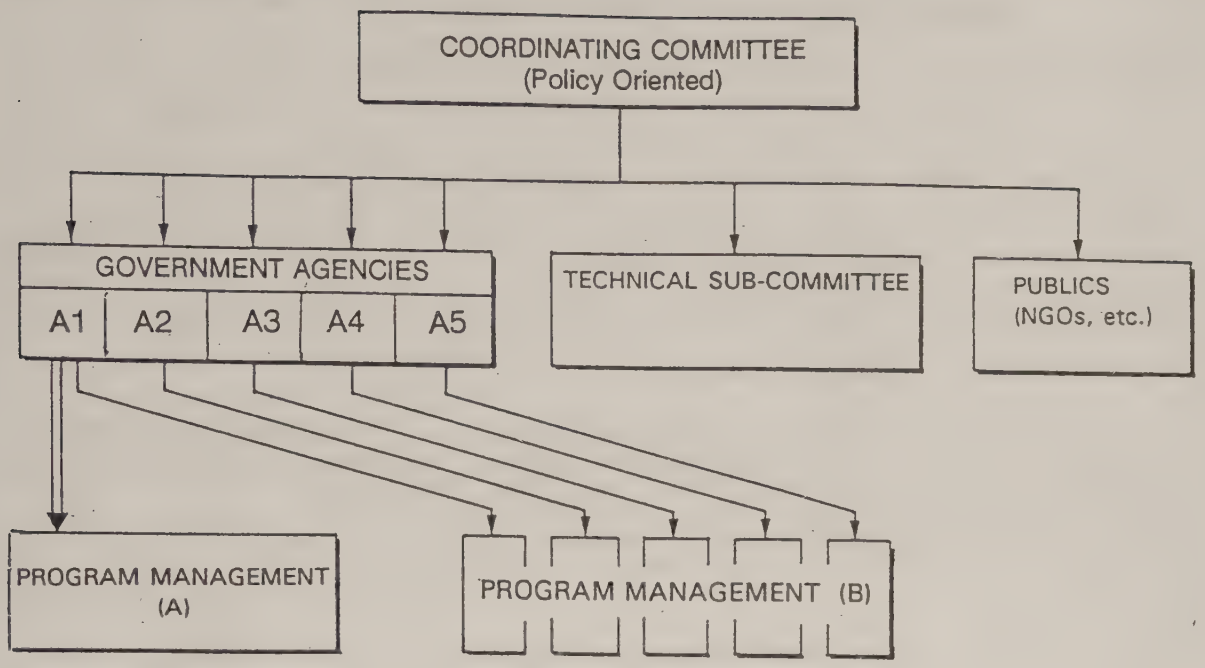
This ability to review coastal development projects - through environmental impact assessment - and to effectively oppose or alter environmentally bad projects, usually does not exist in fisheries departments. An exception is Sri Lanka, where the national ICZM programme was assigned to the fisheries department. But the integrated, centralized, coastal management operation will usually be a special function placed in a special ICZM agency or office, either a coordinating entity or a separate management agency. These two organizational options are illustrated in Figure 6.3.

According to Sorensen and McCreary (1990), three fundamental benefits arising from EAs are: 1) cause-and-effect relationships can be determined with reasonable accuracy and presented in terms understood by policy makers; 2) prediction of impacts will improve planning and decision-making; and 3) the government can better enforce decisions emanating from the environmental process.

The strategic plan will need to recommend the general approach to project review and some particulars about the environmental assessment procedure to be used. For example, it may be useful to do "programmatic" EAs, that is, generic assessments of guidelines, standards, etc., generated by the programme. In this approach, much of the assessment might be done once for each programme element, thus avoiding the need to repeat it for each project that comes under review.

6.13.3 Economic Impacts

For most countries, the motivation for implementing an ICZM-type programme will be very practical. Definite economic benefits - some short term - will have to be shown. Explicit and persuasive social benefits will also be helpful. The values that developed nations put on biological diversity, saving endangered species, and protecting environmental quality are not so fully embraced by developing countries unless they attract international tourists. The burden of proof put on advocates of ICZM is to show clear socio-economic benefits.



Management Alternate A

Whereby one agency manages the coastal program (including, where appropriate, staff secunded from the other agencies

Management Alternate B

Whereby each agency manages components of the coastal program, guided by its designated coordination office

Figure 6.3 ***Two Alternative Institutional Arrangements for Administering an ICZM programme. Source: NPS (1986)***

The complexities of evaluating coastal renewable resources and measuring the economic impacts of development require that special methods be devised and used in ICZM. This requirement applies to countries with economic/political systems ranging from liberal approaches to centrally planned economies. Regardless of the type of economic system that is in place, a special mix of economic trade-off analyses is required for ICZM because of the nature of coastal problems and its common property resources.

The above mix consists of standard economic and financial tools coupled with special approaches developed for coastal natural resources and amenity evaluations. Among the most commonly used approaches recommended are such forms of analysis as: net present value, internal rate of return, and benefit-cost ratio. Other approaches, such as cost-effectiveness analysis, also may be used. Then, there are special analyses developed for situations where market-based, monetary transactions are important - shadow pricing, willingness to pay, etc. It is very important to separate market and non-market values as well as on-site and off-site locations of goods and services (Table 6.3).

Table 6.3 Relation between Location and Type of Mangrove Goods and Services and Traditional Economic Analysis. Source: Hamilton and Snedaker (1984)

		Location of Goods and Services	
		On-site	Off-site
Valuation of Goods and Services	Marketed	**1** Usually included in an economic analysis (e.g., poles, charcoal, woodchips, mangrove crabs)	**2** May be included (e.g., fish or shellfish caught in adjacent waters)
	Nonmarketed	**3** Seldom included (e.g., medicinal uses of mangrove, domestic fuelwood, food in times of famine, nursery area for juvenile fish, feeding ground for estuarine fish and shrimp, viewing and studying wildlife)	**4** Usually ignored (e.g., nutrient flows to estuaries, buffer to storm damage)

An example of effective economic analysis of conflicting uses of coastal resources is the Hodgson and Dixon (1988) study of the effects of logging on tourism and fisheries at north Palawan Island in the Philippines. The biologist-economist team proved convincingly that continued slope-cutting would result in a negative economic future for the region (see Box 6.6 and Figures 6.4 and 6.5).

Unfortunately, there are no simple "cookbook" techniques that can be employed in conservation economics. It will usually be necessary to engage a professional resource economist to assist with economic analyses. If this is not possible, it will be necessary to make the best estimates possible to build a persuasive justification for the ICZM programme.

6.13.4 Alternative Livelihoods

Coastal communities often depend on natural resources in the sea for their livelihoods, on a day-by-day basis. Any restriction on their fishing or other resource extraction activities, for conservation or resource rehabilitation purposes, could be disastrous for people living so close to the edge. Random DuBois (pers. comm.) notes that many rural communities dependent on coastal resources do not have the cushion to risk management actions that might erode even for short periods their means to a livelihood and that politicians may not be willing to enforce conservation rules that would force people beyond the margin.

BOX 6.6 - ECONOMIC ANALYSIS OF CONFLICT : PALAWAN, PHILIPPINES

This case study illustrates how a traditional market solution to a coastal conflict can impose major social costs on society unless there is ICZM-type intervention.

Bacuit Bay on Palawan Island, Philippines, supports major fishing and tourist economies. The surrounding hills contain valuable timber resources (see Figure 6.4) harvested under a government concession. Logging activity leads to substantial soil erosion and sedimentation of the Bay killing corals and disrupting the natural food chain. Decreased fishing makes the Bay less attractive to tourists, and, in turn, brings three major industries into conflict - fishing, tourism, and logging.

To assess the situation, a combined ecologic/economic analysis was conducted by Hodgson and Dixon (1988) for two options: (1) cessation of logging, and (2) continued logging. The results below show that over a 10-year period combined revenues industries are conservatively (at 10% discount rate) 50% greater if logging ceases (values in US$ 1 000) (see Figure 6.5).

	Option 1 Cessation	Option 2 Continuation
Gross Revenue		
Tourism	47 415	8 178
Fisheries	28 070	12 844
Logging	0	12 885
Total	75 485	33 907
Present Value (10%)		
Tourism	25 481	6 280
Fisheries	17 248	9 108
Logging	0	9 769
Total	42 729	25 157
Present Value (15%)		
Tourism	19 511	5 591
Fisheries	14 088	7 895
Logging	0	8 639
Total	33 599	22 125

Author's comment: In spite of the evidence, the logging industry is not expected to cease operation without government action through an ICZM-type mechanism. An ICZM programme could achieve socio-economic balance and protect the common resources of the sea. However, the cease-or-continue outcome may be too simplistic, so an ICZM approach allowing continuance of logging under strict controls on sediment runoff may be indicated.

Source: *Dixon (1989)*

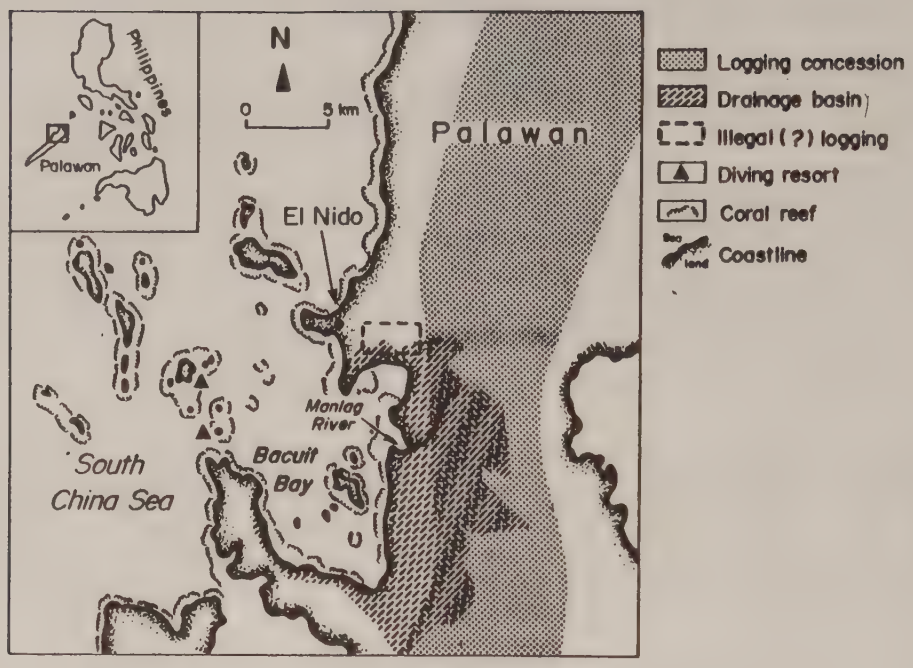


Figure 6.4 *Bacuit Bay, Palawan, Philippines, showing locations of main industries discussed in the text and Box 6.7. Source: Dixon (1989)*

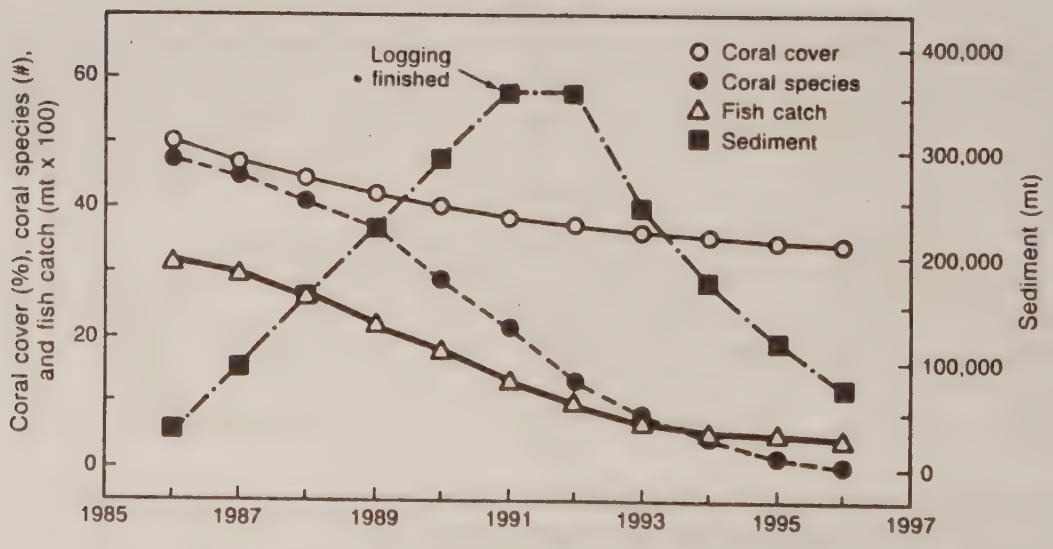


Figure 6.5 *Predicted changes over 10 years in coral species number, percent live cover, and fish catch (in 100 t) because of logging-caused sedimentation of Bacuit Bay. Source: Hodgson and Dixon (1988)*

The question of "alternative livelihood" programmes should be considered, if ICZM results in the loss of employment for certain users of the coastal zone. DuBois (pers. comm.) believes that a promising field in those rural areas characterized by highly degraded coastal resources is the development and provision of alternative livelihood systems designed to provide the "grace period" within which to initiate conservation or resource rehabilitation. When improved, the natural resources base (e.g., mangrove lagoon, barrier reef) can be used to support a sustainable system of resource utilization. This would be a counterpart to such integrated terrestrial programmes as: fast-growing leguminous trees, cut-and-carry systems, contouring drainage for water control, and reforestation currently being applied in upland degraded lands.

In many cases ICZM programmes are being developed in which resources will be/are reallocated to the detriment of one or more stakeholder groups (such artisanal fishermen or coral miners who would be displaced by a tourist development, charcoal makers who would be displaced by a ban on cutting of mangroves). Although the short term economic value of the displaced activities is much less than the value of the proposed activities, and represents a negligible part of gross national product, the negative effects on groups which are often already disadvantaged is likely to have adverse consequences for achieving adoption of an ICZM programme.

Therefore, it is essential that planning for ICZM programmes explicitly include consideration of such distributional effects. This is not to imply that the ICZM agency become an employment agency. Rather, the institutional arrangement for ICZM should include explicit linkage with the relevant agencies, such as the Ministry of Social Welfare, the Ministry of Economic Affairs, which have responsibility for retraining and employment.

6.13.5 Critical Areas, Species and Protected Areas

Effective programmes for protection of species and their habitats will include both regulatory and custodial (protected areas) components, as shown below:

1. Regulatory - The regulatory component provides a broad administrative framework for controlling uses of coastal resources - regulations, permits, environmental assessment, development planning - and operates through administrative process and "police power".

2. Custodial - The protected areas component provides government custodial protection for officially declared parks, nature areas, and resource reserves, and other areas of special resource value, operating through the owner's exercise of proprietary rights and custodial responsibility.

By combining these two, there is created a combined approach that includes both: 1) a regulatory scheme for resource conservation and orderly development, and 2) a specific protected areas scheme for high level protection of special resources (Clark, 1986). The marine parks workshop at the Third World Congress on Parks and Protected Areas concluded: "The aim of coastal zone management ... should be to complement and enhance existing conservation efforts through a coordinating mechanism, an 'umbrella' programme under which coastal and marine protected areas can prosper" (Salm and Clark, 1984).

Marine and coastal parks or other types of protected areas that are designated to protect critical areas are most secure if they are integrated into an Integrated Coastal Zone Management (ICZM) programme. Economic considerations are essential (Table 6.4). Planning for a park in isolation from surrounding land uses and peoples, and without interagency cooperation usually will not work because protected areas that are alienated from a wider programme of coastal resources management exist as islands of protection threatened by surrounding areas of uncontrolled exploitation. ICZM can be organized to prevent pollution from these sources along with overfishing, destruction of "nursery" habitats, and other types of external impact that can be damaging to the protected area. ICZM provides an appropriate framework for integration of protected areas into a larger system of protection and a method of consensus building for their support.

6.13.6 Hazard Prevention

Reducing risk to life and property from natural hazards (e.g., hurricanes, cyclones, typhoons) should be a major element of the ICZM programme. Aspects of hazards risk reduction can be readily combined with resource conservation, thus simplifying the management of coastal development and leading to more balanced decisions. For example, the same setback requirement that protects beachfront structures from erosion and storm waves can also preserve turtle nesting sites on the back beach. Similarly, a restriction on clearing of mangrove swamps will both conserve a valuable resource and maintain a physical defence against storm waves (Clark et al., 1980). In a final example, a seashore or coral reef park could be established to both conserve the reef habitat and protect the inner shore from wave attack during storms (Salm and Clark, 1984).

Human activities that remove or degrade protective landforms - for instance, by removing beach sand, weakening coral reefs, bulldozing dunes, or destroying mangrove swamps - may diminish the degree of natural protection that the coast receives. Natural hazards would usually be addressed in sectoral plans for public health and safety. But natural disasters cut across all sectors. Wind damage from a hurricane, inundation by a tsunami, or rapid coastal erosion can affect tourism, the fishing industry, port operations, public works, and transportation. Housing and industry are also vulnerable.

The solution decided by the State of Western Australia is to provide a setback in order to retain, in public ownership, a buffer strip of land above, and along, the Mean-High-Water line (O'Brien, 1988). The purpose of this buffer strip is to prevent private development from encroaching into the hazardous coastal "edge zone" (see Principle 7). The buffer areas of public land are held in "reserves", a type of protected area (see previous subsection) with a major purpose of keeping development back from erodible and floodable shore areas and to protect edge zone natural resource values.

Troublesome erosion of beaches occurs in developed areas where buildings and roadways have been placed too close to the water's edge and are being undermined or threatened by storm induced erosion. In such cases, the beach is often "armoured", that is, seawalls or groins are built to protect the threatened properties or jetties are built to keep inlets open. But these structures are very expensive and may even worsen the situation. Therefore, they should be closely reviewed by the ICZM authority to see if less expensive and more successful "soft-engineering" alternatives exist (see Principle 9). (Refer to Figure 5.2 for an example).

Table 6.4 **Economic Evaluation of Coastal and Marine Parks and Protected Areas**
Source: Salm and Clark (1984)

Economic Evaluation of Coastal and Marine Parks
and Protected Areas

Since planning should accomplish certain defined goals and objectives, the planner hopes that these will be clearly laid out. However, because such goals are often ambiguously stated, the planner's first job may be to interpret and refine the mandate for the planning process and to request necessary clarifications. In so doing, the planner may find that the programme needs substantial and detailed justification, particularly when it is based on administrative rather than legislative action. The justification may be based on political, social, or economic grounds. Economic justification is now fashionable, and the planner should be prepared to provide the necessary analysis of costs and benefits for the programme.

Quantitative economic indicators of protected area values are usually numbers of visitors or jobs created, tons or value of fishes landed, money or days spent in hunting and recreational fishing, and so on. Examples of measures of monetary benefit are:

- Gate or licence fee totals, to indicate the economic value of tourism to the protected area. These are also indicators of the willingness of the public to pay for recretational privileges at the site.

- Total tonnage at dockside or retail value of fish landings to calculate the contribution of a protected area to fishery revenues (i.e., the economic value of the breeding ground of a fishery resource).

- Total income from recreational and commercial equipment, lodgings, and food and transportation to estimate the contribution of a protected area supporting industries.

- Total hotel catering, product processing and packaging, equipment production (factory) and distribution (outlet), guide, and other jobs in industries linked to the protected area.

- The probable total cost of property damage (to roads, buildings, livestock, and crops) through storm waves and winds (multiplied by the probability of storm damage (i.e., after the felling of mangrove, disturbance of dune vegetation, or blasting of coral reefs) to obtain an estimate of the annual benefit of natural storm damage control.

- The number of visiting students or student groups, their range of ages, and the number of teaching institutions represented. These give estimates of the value of the protected area for education.

- The number of researchers, research projects, theses, and publications, to indicate the value of the protected area to research.

- Head, bus, boat or group counts of visitors to a protected area. The figures can be expressed as a total or a percentage of the state or national population for an estimate of the social value of the site.

Another approach to estimating the value of a protected area is to calculate the cost of rehabilitating the habitats and restoring the species decimated in the absence of area protection.

The next few years will almost certainly see an increase in types and means of quantification for evaluating protected areas.

Certain natural disaster protections are so closely related to resource conservation that they should be included in an ICZM programme. Specifically, water-related disasters - which are virtually inevitable in any coastal nation - result from cyclonic storms, tsunamis, shore erosion, coastal river flooding, landslides and soil liquefaction. The Philippines, Bangladesh, Jamaica and dozens of other countries are affected by severe storms and flooding (Hayes, 1985). In addition to the recognized value of ecological protection, there is the closely allied benefit of protection from natural hazards.

In the strategic plan, recommendations should be made about inclusion of natural hazards prevention in the ICZM programme. This is critically important if no other governmental agency is dealing with the subject of maintaining natural storm defences.

6.13.7 Pollution

The strategic plan should recommend the level of involvement that the ICZM programme would have with pollution control. Since most countries have an existing agency to handle pollution, the validity of transferring coastal pollution control projects to the ICZM programme should be assessed.

6.13.8 Traditional Fishing Rights and Conservation

As stated earlier, communities that have exclusive rights to adjacent marine resources often take responsible action for conservation of those resources. Further, without some control on fishing rights, fishermen have little incentive not to overfish since they cannot prevent others catching what they leave behind (Johannes, 1982).

In ICZM programmes, criteria for legitimate traditional or customary rights and rules of procedure to guarantee their continuance may be needed, particularly where establishment of protected areas for traditional fishing are proposed or valuable tidal lands or lowlands are assigned to private parties.

The IUCN draft "world conservation strategy" (1990) states that the capacity of coastal communities and organizations to manage the resources they use varies greatly with social and economic circumstances. Where indigenous or traditional systems can form the basis of management, communities should be empowered to share management responsibility (Ruddle and Johannes, 1985). Even where such systems have broken down, opportunities for developing new management partnerships between governments and users should be explored. Education and training in conservation may then be necessary.

6.13.9 Public Consultation

The general public must be involved in the formation of new coastal policies and rules on resource use if they are to support them. According to Renard (1986), public participation is a tool available to the entire management community (resource users, public agencies, non-governmental organizations, etc.) to ensure the quality and the effectiveness of the management solutions that will be implemented. He emphasizes that participation is also a duty because "...the issue remains, above all, one of human development" and because ...people are not the object of that development but the subject of development and the makers of their own history".

White (1987) believes that participation comes from wanting to support common values to gain some real or perceived benefit for the individual and the community. Without it, according to White, marine resources can never be conserved nor sustained, because external enforcement of laws in the marine commons is not usually practicable. Chua Thia-Eng (pers. comm.) cautions that "the level and mode of public consultation should be important ... inappropriate timing and unfavourable socio-political, cultural conditions may be counter productive".

6.13.10 Coordination

At the strategic planning stage it is most important to recommend a strong coordinating mechanism to ensure the widest and most effective participation of government agencies, the business sectors, and the public. Having the coordinating mechanism working correctly is clearly the most difficult part of the creation of an ICZM-type programme because coordination is one of the inherent problems of the ICZM process. Numerous private economic sectors and the corresponding numerous government bureaucracies directly or indirectly affect coastal uses, resources, and environments. Horizontal integration is a term that describes efforts to coordinate the separate economic and governmental sectors and thereby reduce fragmentation and duplication (Sorensen and McCreary, 1990).

6.14 Information Needs and Services

Data collection and assimilation is an important part of the strategic planning phase. It is during this phase that the most important decisions will be made about the future of the ICZM programme, or even whether it will have a future. Clearly, these decisions should be made in the most data-rich of circumstances so that the consequences of taking or not taking specific actions are predictable. Because the information needs for a strategic plan depend upon the issues to be addressed and because these vary considerably from country to country, it is not possible to set forth a standard list of information requirements for an ICZM programme from which to prescribe a data compilation programme. However, in Box 6.7 are listed some of the more common information items that strategy planners often need; it should be remembered that the purpose of this stage is to bridge between the policy and the programme development stages. The information is to be used in having an ICZM programme approved or disapproved, if it should be discovered that the country does not need or want ICZM for whatever reasons (see also section 9).

In the strategic planning stage, the information needed is mainly for convincing decision-makers and stakeholders of the need to authorize an ICZM programme, or not to do so, if it is not feasible or appropriate. It should be noted that strategic planning is a reconnaissance level activity and the information required is less detailed than for the programme development stage to follow.

It is expeditious to organize the database so that essential information can be mapped and to display as many categories of data as possible on maps. For example, a Caribbean Conservation Association report (Geoghegan, 1984) states: "It has been found time and time again that perhaps the most useful way for the environmental planner to discover trends, conflicts, and problem areas that can otherwise be easily overlooked, is by mapping information".

BOX 6.7 - TYPICAL INFORMATION NEEDED IN STRATEGIC PLANNING

- Coastal renewable resources: Fisheries and aquaculture activity and yields, by species and seasons; mangrove forest exploitation, activities and products.

- Users of coastal areas and resources: Tourism, manufacturing, maritime trade, mining, urban, oil industry, jobs, revenue, investment and tax yields.

- Impacts: Impairment of coastal resources and ecosystems; pollution, habitat losses, species depletion, sedimentation, visual degradation.

- Upland effects: Impairment of coastal resources from river dams and diversions, accelerated sediment transport, reduction of freshwater inflow, disruption of natural hydro-period, reduction of beach nourishment with erosion and pollution.

- Socio-economic status: economic statistics for coastal communities; social organization of coastal communities and dependencies on coastal resources.

- Critical habitats: Habitats of critical importance such as mangroves and other wetlands, beaches, dune fields, seagrass meadows, coral reefs, tideflats, estuaries, lagoons, shellfish beds, and special breeding and feeding areas for coastal species; restoration needs.

- Critical species: Identification of the coastal species of particular significance or economic value and their habitats; and restoration needs.

- Resource problems, conflicts: Information on special problem situations, such as highly polluted estuaries, extensive mangrove clearing for aquaculture ponds, destruction of coral reefs, etc.

- Natural hazards: Identification of areas of high risk to natural hazards such as badly eroding beaches, floodable lowlands, landslide prone slopes, etc.

- Protection areas: Description of areas that should be designated as reserves or other of protected areas.

6.15 The Incremental Approach

The regional level of implementation (Box 6.8) allows immediate action on the most severe coastal problems, enables a nation to obtain experience with ICZM region by region, provides time to develop and recruit expertise, and presents later opportunity to make needed mid-course corrections (Sorensen and McCreary, 1990). Major port and lagoon (or estuary) complexes are the focus of the greatest intensity and number of coastal resource conflicts, and the greatest environmental degradation. As a result, national interest in ICZM may focus on one or several of these complexes. One region of concern may be an urban centre surrounding a major port and its associated bay, lagoon, or estuary. Other examples in this region may include regions of lowland agriculture, coastal rural settlements, tourist regions of beaches or natural phenomena like flamingo or ibis migrations.

A second type of incremental approach is to define specific resources or problem areas to initiate the ICZM management process. It may be expeditious to focus first on problems of limited geographic scope, such as shoreline erosion, loss of coral reefs, or degradation of estuarine fish spawning areas, using the strategies of critical area designation or shoreline exclusion setbacks (Sorensen and McCreary, 1990). "Critical area" designations and "exclusion zones" are relatively inexpensive and simple to administer. Either strategy can be implemented on a 10-site specific basis, commensurate with available information, staffing, or expertise. They can be reinforced with regional planning or broad sectoral planning of larger geographic scope: combining wetside (estuarine or marine area) protection with dryside (shorelands) management strategies offers the possibility of managing whole coastal ecosystems.

A third type of incremental approach is at the administrative level, whereby all the ICZM functions are not implemented at one time, but rather are implemented function by function. For example, the programme may start with project review (environmental assessment) only and without planning or technical services which will follow at later phases of implementation. The incremental approach to ICZM implementation provides the opportunity to test concepts and approaches as a pilot effort before committing energies and political capital to full-scale nationwide effort. The risks and consequences of failure are considerably less when a programme is implemented incrementally.

A national ICZM programme does not have to be initiated all at once. It can be implemented either region by region, resource by resource, or function by function.

ICZM-type programmes can benefit from the regional planning approach in at least two different ways: 1) the national ICZM programme can be organized to implement individual "Regional Unit" programmes if it has the flexibility to recognize regional distinction, and 2) the national ICZM programme can be organized to facilitate input into presently ongoing regional economic development planning activities. If either the first option (specific regional ICZM programme) or the second (facilitated input into regional development planning) are chosen, it is appropriate for coastal interests to understand what regional planning is and how it operates. [Note: one of the best reference documents on regional planning is "Integrated Regional Development Planning" produced by the Organization of American States (OAS) in 1984, in cooperation with the US Agency for International Development (USAID) and the National Park Service of the US Department of the Interior.]

Box 6.8 - ECUADOR'S REGIONALLY ORGANIZED ICZM

CASE STUDY

The proposed ICZM-type programme for Ecuador is an example of a well-planned regionalized approach. Four specific coastal regions have been designated as regional ICZM units, termed "Special Management Zones" Each of these units - one is proposed for each of the country's four coastal provinces - would have a separate Advisory Committee composed of government and private sector representatives. A special effort would be made in each region toward coordination and enforcement of existing regulations - it is believed that sufficient regulations already exist and that the major task of the ICZM-type programme is ensuring that they are enforced appropriately.

Source: Matuszeski et al. (1988)

In selecting the boundaries for the Regional Unit Initiative many factors have to be considered, including existing political subdivisions and traditional ways of regional thinking. But to the extent possible for ICZM purposes, the region should reflect the natural boundaries of the landscape.

6.16 International Aspects

Linkage should be identified between national ICZM programmes and current international initiatives on biodiversity conservation, marine debris and entanglements, drift nets, endangered species, hazardous wastes, wetland protection, global warming and other related climatic changes, and control of biotechnologies.

In fisheries, the relations between the coastal seas, the EEZ, and High Seas management must be clearly understood. The United Nations Convention on the Law of the Sea (UNCLOS) provides a framework for conservation and sustainable use. FAO has the responsibility for management at regional level, through regional fishery bodies. Other non-FAO fishery bodies exist with similar functions, some created under the aegis of FAO. These bodies provide the basis for international cooperation.

For pollution, the Montreal Guidelines for the Protection of the Marine Environment against Pollution from Land-based Sources, drafted by the United Nations Environment Programme (UNEP), could be the basis for agreements. The World Meteorological Organization (WMO) is developing a technical annex covering marine pollution via the

atmosphere, to be attached to the Protocol for the Protection of the Mediterranean Sea Against Pollution from Land-based Sources.

For protection of species and their habitats, there are a number of important instruments. For example, "the Ramsar Convention" (an international treaty for protection of wetlands of international importance) which has provided extra protection to many important coastal wetlands. Also, the Regional Seas Programme of UNEP has encouraged international "protocols" for conservation of natural areas and protection of species (e.g., Mediterranean Sea, Eastern Africa, Southeast Pacific, Caribbean Sea).

Few countries have adequate contingency plans and emergency response procedures for oil spills. Current international agreements have greatly reduced oil pollution from shipping. But they need stricter enforcement, along with provisions of guidelines. The International Maritime Agency (IMO) is preparing a convention on emergency preparedness and response. UNEP'S Regional Seas Programme deals with maintaining the quality of regional marine habitats and has a useful role to play in ICZM.

Transnational issues related to ICZM requiring international cooperators include shared stocks, highly migratory species and transboundary stock, maritime stock, maritime boundary resolution, straddling oil and gas deposits, and transboundary pollution. These issues are said to be most significant in enclosed or semi-enclosed seas because the regions usually involve a multiplicity of countries and interests. Thus, in planning coastal seas activities, it will be necessary to consider effects on adjacent countries.

The development financing agencies (World Bank, USAID, EEC, Inter-American Development Bank, Asian Development Bank, etc.) are slowly but surely realizing the environmental limitations to development. They can play a useful role as motivating and coordinating forces. The client countries themselves are showing more interest in sustainable development and related issues but are concerned with food security and looking for an equitable sharing of the costs of world environmental protection.

In this case, however, international implications related to implementation of UNCLOS and considerations related to ocean management should be taken into account. If, finally, the coastal zone has strong links with offshore resources (highly migratory), activities and oceanic processes the Large Marine Ecosystems (LMEs) concept might apply.

7. PROGRAMME DEVELOPMENT

This section describes the programme development phase. Here are emphasized the processes involved in programme development rather than the technical aspects. Programme development is the third phase in the four-stage ICZM sequence described in the previous section. Detailed technical material for programme development is given in four publications in the "Coasts" series of the US National Park Service (see Clark, 1985; Clark, in press (a); Snedaker and Getter, 1985; Sorensen and McCreary, 1990).

Like any structural model for governance, the approach described below is more instructive than prescriptive. Each country will have to choose and develop an ICZM structure that is most suited to its own programme needs.

Effective coastal and marine conservation programmes should include both protected area and regulatory components. Protected areas provide custodial protection for areas of special resource value through exercise of proprietary rights. The regulatory component, directed by the ICZM programme, provides a broad framework for controlling uses of coastal resources, including regulations, permits, environmental assessment, and development planning, operating through administrative process. By combining the two, there is created both 1) a regulatory scheme for resource conservation and orderly development and 2) a specific protected areas scheme for high-level protection of special resources.

7.1 Programme Scope

The ICZM programme covers such activities as policy-making, enforcement, boundary definition, zoning, monitoring, development of guidelines/standards and appropriate control measures, incentives and disincentives. It designs a framework that will incorporate all the aspects examined previously in this report. Specific management mechanisms are discussed in the following section.

In programme development, emphasis should be put on articulation of goals and objectives and on the preparation of guidelines for development management, environmental protection, and multiple-use planning. Such programmes should include mechanisms for the anticipation and resolution of conflicts and the preparation of the Coastal Master Plan (Clark, in press (a)).

ICZM should relate to the broader national economic planning process through components on resources planning, land-use planning, and economic planning. Advice should be available from ICZM for government agencies, developers and other stake-holders and to the general public regarding economic development options. The ICZM entity should also transmit to the national planners any coastal needs for legislation, new programmes, improved policy base, and interagency coordination.

The programme should address such peripheral aspects as natural hazards and watersheds. Natural hazards prevention and mitigation should be integrated into the ICZM

programme, including defences against any sea level rise caused by global warming. Influence on watershed management should be gained in order to lower the risk of agricultural and other pollutants washing off the land and entering coastal waters.

Regarding environmental restoration, all critical habitats that have been degraded should be rehabilitated to the highest possible level of productivity and biodiversity. Current rehabilitation techniques require research and careful evaluation. The research should include prediction of the effects of environmental change (including climate change) on critical coastal habitats and on living resources they support.

Ocean management is not the focus of ICZM, but in some countries ocean management and ICZM may be brought closely together (e.g., Brazil). Ocean manage-ment is usually a national enterprise, conducted as a multi-agency, multi-sectoral, initiative. Issues of greatest concern include shipping, offshore fisheries, mineral exploration and development, oceanic pollution control, and ocean research. Recent agreement on the "Law of the Sea" regime has stimulated many initiatives in national ocean management. These may in turn enhance ICZM-type programmes as ocean concerns are felt along the land/ocean interface. Sweden, Sri Lanka, and Brazil appear to exemplify this trend (Joliffe and Patman, 1985).

7.2 The Problem-Solving Approach

ICZM is a problem-solving programme. For example, Healy and Zinn (1985) list numerous concerns that have been addressed by more than 30 States participating in the US coastal zone management programme during 1973-1982, its first 10 years (Table 7.1). This study was accomplished by screening 1 044 reports and studies produced on behalf of State coastal agencies.

In another example, four major categories of problems were identified by the Philippines Government as those to be addressed in an ICZM-type programme (Box 7.1).

National legislation may need to be adapted to provide the regulatory tools needed for ICZM programmes; e.g., modern methods of environmental impact assess-ment (EIA). Fisheries legislation should be improved to integrate considerations regarding habitat conservation and pollution control in addition to traditional concerns regarding fisheries management and sustainable development.

7.3 Opportunities and Obstacles

Serious governmental interest in ICZM will probably start with a perceived use conflict, a severe decline in a resource, or a devastating experience with natural hazards. Launching a coastal programme demands strong motivation. Such motivation can arise from events that dramatize the importance and vulnerability of coastal resources.

The potential long-term socio-economic benefits of coastal management must be evident to decision-makers for environmental quality and natural area protection to enjoy continued support. Fisheries productivity, increased tourism revenues, sustained mangrove forestry, and security from natural hazard devastation appear to be the four most common and persuasive arguments for ICZM-type programmes (Sorensen and McCreary, 1990).

Table 7.1 **Environment and Development Concerns in Coastal Management (Number of Citations Out of a Possible 1 044)**
Source: Healey and Zinn (1985)

Development concerns		Environment concerns		Environment/development interactions	
Recreation/tourism	140	Coastal resources	118	Erosion/sedimentation	90
Petroleum industry	65	Wetlands	103	Environmental impact	38
Energy facility siting	65	Fish/fisheries	85	Conflicting uses	36
Facility siting	62	Public access	82	Floods/flooding	34
Ports/waterfronts	58	Critical areas	48	Oil pollution/effects	29
Energy	45	Vegetation	47	Energy impacts	21
Transportation	43	Marine biology	46	Pollution	17
Industry/commerce	42	Wildlife	46	Water pollution	13
Population	29	Water quality	44		
Dredging	29	Beaches/dunes	36		
Marinas	28	Water resources	35		
Boating	25	Estuaries	34		
Growth	22	Aesthetics	28		
Shipping	18	Resource protection	22		
Agriculture	18	Living marine resources	21		
Water development projects	14	Cultural/historical resources	12		
Navigation	14	Groundwater	10		
Oil and gas	14	Barrier islands	8		
Marine mining	9	Open space	7		
Coal transportation/storage	9	Preservation	5		
Energy transportation/storage	9	Coral reefs	4		
Forestry/logging	7	Air resources	3		
Waterfront development	7				
Aquaculture	6				
Total	778	Total	844	Total	278

BOX 7.1 - MAJOR COASTAL RESOURCE PROBLEMS IN THE PHILIPPINES

- Natural resources degradation: (a) beach erosion; (b) conversion of mangrove swamplands into other land uses; (c) landfill or reclamation of foreshore areas; (d) dynamite fishing; (e) overfishing; and (f) over-exploitation of mangrove forests.

- Pollution: (a) industrial sources (industrial waste); (b) domestic sources (household wastes and solid wastes); (c) agricultural sources (pesticide and fertilizer runoff); and (d) other sources (dredging activities).

- Land-use conflicts: (a) absence of access to foreshore lands due to human settlements encroachment; (b) unusable beach areas due to excessive pollution; and (c) conservation and preservation of mangrove areas versus conversion of the same into fishponds, or reclamation of the same for human settlements and commercial purposes.

- Destruction of life and property by natural hazards: (a) flooding due to storms; (b) tropical cyclones; (c) earthquakes; and (d) tsunamis.

Source: *NEPC (1983)*

At present there is no one correct model for integrated management of coastal zones. But there is a family of coastal zone related management schemes that include shorelands and coastal seas (Clark, 1990). These are variously entitled: "coastal zone management" (CZM), "integrated coastal zone management" (ICZM), "coastal area management and planning" (CAMP) or "coastal resources management" (CRM). Each refers to a slightly different form of governmental intervention for the purpose of developing coastal resources sustainably while protecting the natural environment (Sorensen and McCreary, 1990). The most appropriate terminology for the purposes of this report is ICZM (Clark, 1991).

In an integrated management format there are two "foundation blocks" to be addressed. First, is the zone of sea and land to be included. Here, it is the resources and/or environments to be managed, according to issues analysis and the resulting programme goals that define the geographic extent of the coastal area or zone.

The second matter concerns the dictates of policy and resulting subjects and issues to be addressed. A basic pre-condition for the determination of a national marine policy is identification of problems and opportunities in the coastal/marine area under its jurisdiction. It may be helpful to examine the failures of ICZM programmes as well as successes. For example, Hildebrand (1989) lists the following reasons to explain why a Canadian initiative for a nationwide ICZM programme failed in the early 1980s:

1. Lack of agreement on a satisfactory definition of the coastal zone
2. Political boundaries vs. ecological boundaries
3. Coastal zone treated as a common property resource
4. Lack of awareness of coastal zone problems
5. No clear motivation for CZM
6. Administrative fragmentation
7. Lack of clearly stated goals
8. Dominance of short-term management over long-range planning
9. Inadequate information on which to base decisions
10. Attitudinal problems
11. Ran against political and economic grain of the time.

Unfortunately, national development decisions are usually made according to single-sector priorities without sufficient knowledge or understanding of the impact these narrow decisions may cause on other sectors. In addition, at the planning or budget level, the inputs of many sectors may conflict and pull in different directions (see Table 7.2). Traditional economic sectors, each with its own clientele, compete for funding, resources and political advantage (OECD, 1990).

It would be virtually impossible to allocate the coast to a single one of these economic sectors for development, or even to give one or two sectors a priority for coastal development. In fact, it is the intense conflict over use of the coast that so often arise among the various sectors that makes both the ICZM process and multiple-use necessary.

7.4 Institutional Mechanisms and Inter-Agency Coordination

Involvement by all levels of government will be required for coastal management programmes such as ICZM. At one extreme, the local governments are involved because they govern where development takes place, where resources are found, and where the benefits or penalities are mainly to be felt. At the other extreme, the Central Government

Table 7.2 **Examples of Positive and Negative Relationships Among Sectors. Source: Sorensen and McCreary (1990)**

SECTORS RECEIVING IMPACTS	SECTORS GENERATING POSITIVE AND NEGATIVE IMPACTS					
	Ports and Shipping	Transportation	Public Works	Fisheries	Tourism	Additional Sectors Can Be Portrayed
TOURISM +	Passenger liner facilities	Airports and roads to tourist areas	Infrastructure for tourism development	Conservation of habitat areas vital to both recreational and commercial species		
TOURISM −	Ship pollution in beaches and swimming areas	Encroachment of urban dev. produced by roads	Encroachment of urban dev. produced by public works	Air & water pollution from fish processing industries & boats		
FISHERIES +	Harbors and processing facilities	Roads and railroads to ship products	Sewage from processing		Sportfishing opportunities	
FISHERIES −	• Ship pollution • Wetland fill	• Wetland fill • Estuary fragmentation	Wetland fill for development produced by provision of public works		• Pollution from fish processing • Fill of wetlands for tourist facilities	
PUBLIC HEALTH & SAFETY +	Docks & channels enabling evacuation before storm & flooding	Roads & bridges for evacuation before storm & flooding	Public works such as dams & revetments to reduce or eliminate hazards	Fisheries development increases both amount & healthfulness of product	Improvement in quality of public water supply &/or sewage treatment	
PUBLIC HEALTH & SAFETY −	Port development in hazard-prone areas	Provision of transportation stimulates development of hazard-prone areas	Provision of public works stimulates development of hazard-prone areas	Water pollution from fish processing industries & boats	Development of tourist facilities in hazard-prone areas	
Additional Sectors Can Be Portrayed						

+ Sector reinforces or has positive impacts on another sector
- Sector has negative impacts on another sector

has to be involved because responsibility and authority for marine affairs inevitably rests there - navigation, national security, migratory fish, international relations, etc. (Figures 7.1 and 7.2). At the intermediate level, Provincial or Regional governments are involved because they also often have financial and administrative responsibility in the coastal area.

ICZM requires "horizontal integration" of all these national agencies (and their private sector clientele) as partners. While no hierarchical arrangement may be needed, or possible, there should be a lead agency or a coordinating office. In the initiation of an ICZM programme, strong, sectorally-oriented agencies may be disturbed about their potential loss of power and autonomy that might result from creation of new institutions or reorganization of existing ones. UNESC (1987) state that this may be one of the most significant barriers because bureaucracies are known for "protecting their turf" (OAS, 1984).

Experience shows that it may be more expeditious to set up a strong coordinating office in an appropriate ministry, or at the executive level, to administer the ICZM authority. In this way the actual programme work would be spread among various departments. This would be simpler than to structure a whole new department with autonomy.

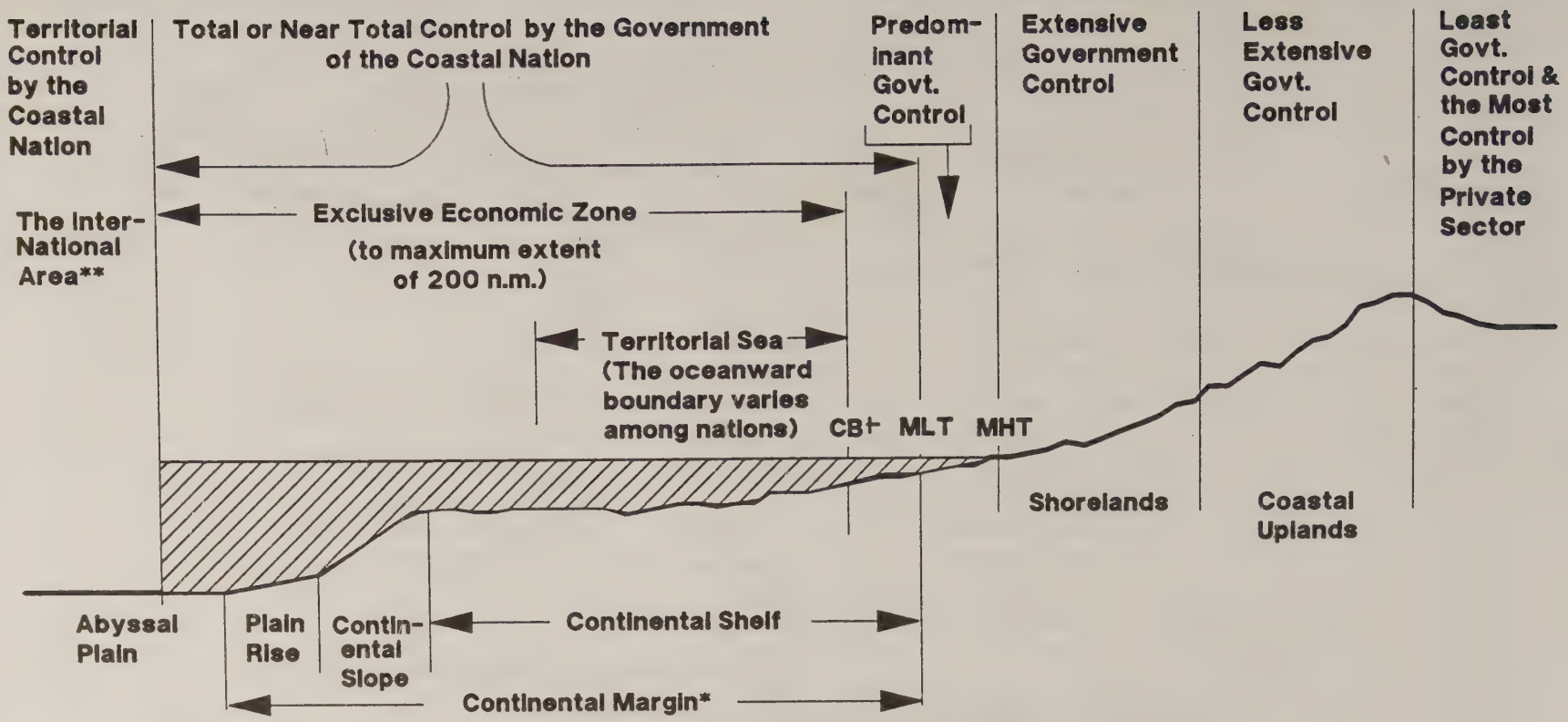
The ministries having mandates in broad economic or social sectors will usually have only a partial responsibility with respect to the marine area under national jurisdiction (OAS, 1984). For example, fisheries may fall under a ministry of agriculture, maritime transport under a ministry of transportation, offshore oil and gas development under a ministry of mines and energy and so on.

Coordination of coastal-use management within the framework of development planning represents a major challenge to both developed and developing countries. The main objective is to strengthen the capabilities of countries to fulfil their responsibilities for development and conservation of coastal areas and to increase global efficiency.

A framework must be established for collaboration, integration and communication (through development of appropriate mechanisms and institutions) between sectors in a country and possibly between countries in a region. In addition, institutional cooperation must be strengthened between international agencies and between donors.

Institution-building for integrated planning and management of coastal marine areas and their inclusion within the framework of national development planning require the following: 1) restructuring of governmental institutions responsible for the development and protection of coastal seas; 2) development of coastal and marine policies and programmes for which national capabilities need to be created and coordinated; 3) fostering technical cooperation among developing countries in the field of ocean and coastal planning and management by establishing or strengthening appropriate mechanisms; 4) promoting public awareness of the importance of the sea, its products and its conservation in national development strategies; and 5) developing the capacity to implement existing international agreements including the drafting of appropriate national legislation.

Because all levels of government must be involved in ICZM (see Principle 8) along with development interests and resource users (see Principle 13), the task of coordination with the variety of "stakeholders" is complex and important. The decision-making and implementation processes must be shared among these interests, requiring efficient communication and effective dialogue. Information-sharing is especially important (Box 7.2).



*In a number of places, the continental margin extends oceanward beyond 200 nautical miles. In these situations, the oceanward boundary of the national jurisdictional claim can be the outer edge of the continental margin.

**The international area is the seabed and ocean waters beyond either the continental margin or the exclusive economic zone (whichever is greater). Under the 1982 Law of the Sea Convention, the International Seabed Authority has some management authority, particularly with respect to marine mining.

†CB - The coastal baseline is a series of straight lines that interconnect coastal headlands and promontories. The CB is the reference point used to map the oceanward boundary of both the territorial sea and the exclusive economic zone.

MHT - Mean High Tide

MLT - Mean Low Tide

Figure 7.1 Extent of Government Control in the Management of Marine and Coastal Resources and Environments
Source: Sorensen and McCreary (1990)

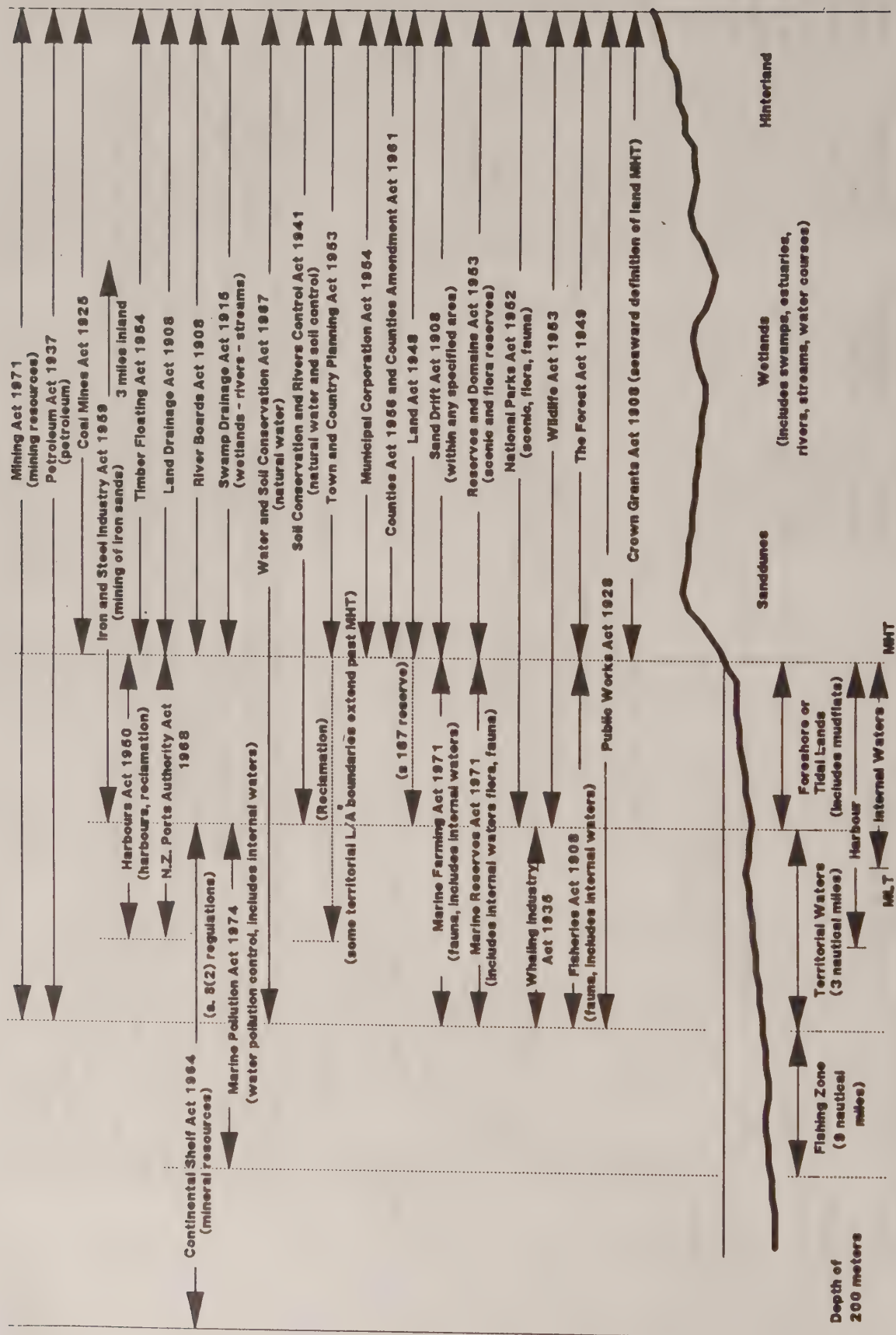


Figure 7.2 Legislative Administration of the Coastal Environment of New Zealand. Source: Sorensen and McCreary (1990)

BOX 7.2 - COASTAL RESOURCE MANAGEMENT (CRM) STATUS IN INDONESIA

The main problem with existing CRM in Indonesia [in 1985] is that a central integrated and coordinated programme has not yet been established, although the basic legislation has been passed, the lead ministry identified (Population and Environmental Affairs) and a coordinating committee among the ministries proposed. Single purpose sectoral projects advocated by one line ministry (or subordinate counterparts at provincial or kabupatens level) presently do not consider the adverse CRM and environmental effects and can conflict with the programmes of other ministries (or subordinate equivalents). As a consequence, poor, uninformed, decision-making results, and coastal use options are unnecessarily compromised and resources lost.

The goals of a CRM programme would be to provide the framework for resolving conflicts among single purpose proposals in a specific region, by evaluating the consequences of individual projects on other activities and selecting alternatives that maximize multiple and compatible use and minimize unnecessary foreclosures of option or losses to coastal resources. The following components should be included in the programme: policy and plan formulation, training, research and development, pilot-level implementation, dissemination of information, periodic adjustment of programme goals, and gradual expansion of the programme throughout the provinces of the country.

All the above components would be a part of both national and provincial initiatives, but most of the actual management and decision-making would occur at the provincial level while most of the important policies and guidance including those of national significance would be developed and monitored at the national level. The above components also serve as the general sequence for programme evolution.

Policy and plan formulation would refine existing policies, develop new ones, and develop implementing procedures (regulations). Coordination with conservation and development agencies would be accomplished until an integrated national plan and process is adopted. Gradually this would filter down to the provincial level. After specific regional plans and a process is established, day-to-day CRM would be initiated at the provincial and lower levels.

Source: Burbridge and Maragos (1985)

Public hearings or consultations may be appropriate in advance of particularly important decisions. For most programmes it will be desirable, if not essential, to establish an "interagency coordinating committee" to review progress, consider programme changes, discuss proposed new rules, receive advice, and consider actions on specific development applications and resource management proposals. The benefit of widening the involvement in ICZM beyond government agencies to include the public is particularly emphasized for small island countries such as those in the Caribbean (Box 7.3).

The ICZM authority must have influence over a wide range of ministries and agencies - e.g., finance, agriculture, economic planning, commerce,. tourism, forestry, and transportation - and often take a position on coastal development or conservation that is adverse to one or more of them. As Joliffe has said: "It cannot be assumed that diverse authorities, such as government departments, local government authorities, conservation agencies, port and harbour authorities, water and river authorities, and many others, will, without prodigious effort and goodwill, coordinate their policies in relation to coastal problems" (Joliffe and Patman, 1985).

Without exception, institutions will defend their turf and only yield authority and prerogative. Convincing institutions to cooperate in multi-sectoral activities toward ICZM goals that no single institution can accomplish singly is certainly one of the toughest jobs for the ICZM authority. Without centralization of authority - 'i.e., above the level of the individual ministries or departments of government - ICZM success will be minimal.

Few countries will have an interagency or interministerial entity already in existence which is positioned to take on an ICZM programme. Therefore, a lead agency with an interagency mandate will usually have to be created to accomplish the coordinative management and planning functions of ICZM. As Joliffe and Patman (1985) state the case: "...what is quite clear is that existing planning and management agencies are essentially land or sea-based and that the littoral zone normally marks a jurisdictional boundary rather than the vital focus for coastal planning and management."

The ICZM office within the lead agency should be mandated, staffed, and budgeted to accomplish at least the minimum three tasks listed in section 4: 1) interinstitutional coordination on coastal resource conservation matters, 2) review and comment on all major coastal developments, and 3) compliance with ICZM rules and decisions. A simplification that has merit is "networking", whereby agencies have individual tasks to perform under a coordinated mechanism (Box 7.4). Other tasks that may be added as possible to build a full-service ICZM operation are described later in this section.

7.5 Training and Public Education

Awareness must be raised among the public, the managers, and the developers concerning the integrated nature of the problem, the consequences of resources mis-management, and the importance of the maritime dimension in national planning and development strategies.

Education is needed in the skills required for ICZM, particularly for fact-finding and managerial personnel who formulate policy and organize programme elements involving skills in law, economics, and development management.

BOX 7.3 - INVOLVING LOCAL COMMUNITIES IN ICZM

Implementation of management programmes is not and should not be an entirely governmental responsibility. Resource management objectives can be pursued by local communities, resource user groups, schools, and other formal or informal collectives. For example, fishermen's cooperatives have proven to be extremely effective tools for implementation of development objectives in Guyana, Nevis and Barbados. Government has provided incentive, but the organization has remained non-governmental. Often, local communities and resource users have developed management techniques to sustain their traditional resource use, and these techniques can be exploited... Government regulation, on the other hand, can often make the resource user feel out of control of his destiny and out of touch with his environment.

To a particular community, their special problems may have more importance, and government's inability to see their situation can be frustrating. Communities can resolve many of these special problems themselves by freely exchanging ideas and information and working towards commonly acceptable solutions. Government can assist by being a receptive part of this problem-solving process, working to understand the problems of individual groups, and supplying technical or institutional assistance to encourage local efforts.

Particularly in rural communities, many people do not receive wages or salaries, but rather depend on activities like subsistence fishing, small scale farming, or trade for their survival. An increase in the per caput income is unlikely to affect these people; development for them means increased ability to carry out the activities on which they rely. Actions that close options off by concentrating on purely economic development can wind up creating more problems than they resolve. When, for example, commercial fishing is developed to the point of squeezing out the subsistence fisherman, the net result to the community can be negative, despite apparent economic growth.

Source: Geoghegan (1984)

BOX 7.4 - OMAN: AN EXAMPLE OF THE MULTIPLE JURISDICTION, OR NETWORKING, APPROACH TO ICZM

CASE STUDY

The success of any plan that implicates different ministries, as this Coastal Zone Management Plan (CZMP) for Oman does, depends on two principal factors:

- information exchange and cross-sectoral review; and
- effective coordination for plan implementation.

A lead agency should assume primary responsibility for coordinating these two tasks. Since the Ministry of Commerce and Industry has commissioned this CZMP, it is assumed that this responsibility should rest with them. However, certain specialized tasks relating to the management of the various resources fall directly into mandate of other ministries which should assume that responsibility for them.

Thus, in the ICZM recommendations, tasks pertaining to different activities are assigned as follows:

- land-use policy, planning, and allocation: to the Ministry of Housing

- recreation and tourism policy, planning and management: to the Ministry of Commerce and Industry through the Department of Tourism

- fisheries support systems management: to the Ministry of Agriculture and Fisheries through the Directorate General of Fisheries

- implementation of environmental policy: to the Ministry of the Environment and Water Resources

- protected areas management: to an existing management authority in the Capital Area pending acceptance of implementation of recommendations of IUCN Project 9069

- control of roads, harbours, and coastal works: to the Ministry of Communication

- site implementation of policy: to the Capital Area Municipality and the Ministry of Regional Municipalities throughout the respective municipalities

- enforcement of environmental and species protection regulations: to the Royal Oman Police

Source: Adapted from Salm (1986)

Training programmes should be developed on various aspects of ICZM planning at national and regional levels, including seminars and workshops for policy-makers and planners, short-term courses, development of new academic programmes aiming at the development of multidisciplinary competencies (e.g., law of the sea, environmental economy, socio-economy, sociology, demography), preparation of training materials (manuals, simulations, audio visual aids) for various strata of the public, including the rural communities (Clark, 1991b).

7.6 Creating the Master Plan

A Coastal Master Plan is the final product of the basic ICZM planning activity. It provides a detailed representation of the coastal zone and an inventory of the resources, an identification of critical areas, specifying those in need of special attention and those offering potential for development.

The Master Plan identifies the permissible type of uses and the standards for these uses, the procedure for permit approval processes, for monitoring of activities and enforcement of compliance. It indicates options for human progress in the coastal area - e.g., it recommends governmental and private actions to accomplish beneficial and sustainable change; i.e., change that is economically sound and socially just and that maintains the natural resource base. It should have a complete set of objectives as its foundation.

Objectives of the Master Plan could include any of the following: 1) maintain a high quality coastal environment; 2) identify and protect valuable species (and their intraspecific variations): 3) identify and conserve critical coastal habitats and identify lands that are particularly suitable for development; 4) resolve conflicts among incompatible activities affecting coastal and ocean resources and the use of space; 5) identify and control activities that have an adverse impact upon the coastal and marine environment; 6) control pollution from "point sources" and from land runoff as well as accidental spills of pollutants; 7) restore damaged ecosystems; 8) coordinate governmental efforts to promote the sustainable development of coastal and ocean resources; 9) balance economic and environmental pressures as they affect development and conservation of coastal and ocean resources; 10) provide guidance for coastal development planning to reduce inadvertent side effects; 11) analyse and prepare safer options for coastal development; and 12) raise public awareness.

In collecting data and synthesizing information for the Master Plan, the kinds of information needed for the strategic plan are those that will enhance the decision-making process, that clearly depict the trade-offs. The Master Plan has a fixed time frame to which the strategy of its creation must be adapted. And it must be recognized that each version of the plan is only an interim statement since the plan basis will be constantly changing and therefore in constant need of updating.

7.7 Continuing Information and Planning Needs

To assume that planning ends with programme development would be incorrect. In an effective ICZM programme, planning is a continuing process, perhaps even more at the tactical than at the strategic level. Because conditions change and the ICZM programme is always gaining experience and evolving, planning must be an ongoing activity. The planning function should include the more technical aspects of the programme and the more scientifically trained staff.

In the ICZM programme development structure suggested herein, where management functions are separated from planning functions (somewhat arbitrarily), a permanent planning unit can be annexed to the ICZM staff or planning services can be obtained from universities, research institutes (as in Trinidad and Tobago) or consultants.

The planning unit would handle a wide variety of services in the areas of data collection, planning, education, special programmes, advisory technical services, and research. In a modest programme for a small country the ICZM planning unit might consist of one or two professionals with additional outside assistance as needed.

The planning unit's initial priority should go to supporting the management unit in its work (Box 7.5). This would mostly entail furnishing technical background material, including surveys and delineations of special areas. Much of the output would be maps and overlays.

BOX 7.5 - EXAMPLE SERVICES PROVIDED IN THE EXPANDED ICZM MODE

- Technical services: planning, information management, survey and mapping, monitoring, research, economic analysis, and technical advice to developers, government agencies, and interest groups.
- Education services: information dissemination, public education, staff training, extension services.
- Guidelines: formulation of standards and guidelines for coastal development, and publication and update of the standards and guidelines.
- Restoration activities: assessing the state of coastal renewable resources, determining restoration needs, designing restoration projects.
- Protected areas: determining the need for the establishment of a system of parks, reserves, or other types of protected areas, priorities for site selection, creation of management plans.

7.8 Management Mode

In reactive mode, integrated management is an issue-driven process and the nature of the particular issues dictates the type of programme to be created and the boundaries of the programme. In this mode, the effort and expense required to set up an ICZM-type programme would not be justified unless there were multiple issues of importance to be addressed.

In prescriptive mode, integrated management is part of the national development planning process and may help to avoid the most serious conflicts by making the "right" decisions early in the process. This consideration is particularly important for developing countries.

In concept, ICZM can be as simple as a programme of impact assessment for development projects; or it can be as complex as a comprehensive, full service, programme of economic development, conservation, education, and social well-being. In the minimal mode, it is anticipated that the programme would mainly review developments and issue permits for acceptable projects are examined.

In an expanded mode, the ICZM programme would broaden out to include additional functions needed for a more complete programme. Examples of some of the more valuable additional functions are shown (see Philippines example in Box 7.6).

7.9 Management Boundaries

Planning boundaries were discussed in the previous section. Here the final boundaries for the management zone are examined.

According to Sorensen and McCreary (1990), because there is a broad array of possible coastal issues, there is a broad array of possible ICZM management boundaries (Table 7.3 and and Figure 7.3). Some boundaries are quite narrow, and are best suited to deal with use conflicts occurring at the immediate shoreline. If watershed-generated impacts are of concern, then a coastal management boundary extending inland would be justified. Likewise, if the issues extend over all the sea area under national jurisdiction, then the whole EEZ should be included.

To best accomplish the purposes of ICZM, the coastal zone area should be divided into management "tiers", each representing a management unit characterized by different resources, issues and jurisdictions.

An approach using four tiers is shown in Box 7.7. In this approach, one tier would be the marine and coastal waters (wetside) and would be adjusted to reflect fisheries and port sectors, the importance of nearshore spawning and nursery habitats, and regional and international matters. A second would be the primary coastal zone, or "edge zone" defined to include all the transitional areas between land and sea - wetlands, coral reefs, sea grass beds, estuaries/lagoons, beaches, tidal rivers, and flood plains. A third tier (dryside) would include the shorefront that borders the transitional area and would address coastal development and storm-flooded areas. A fourth tier would be all the areas inland of the primary zone that have critical linkages to the primary zone and its resources and would address watershed problems (Salm and Clark, 1984).

BOX 7.6 - PHILIPPINES ICZM STRATEGY

CASE STUDY

The following 12 items, listed as "strategies and targets" for the "enhancement of the coastal zone" of the Philippines show how important the information component is in an ICZM-type programme:

- Generation of baseline information about coast zone resources
- Identification of the present status of coastal resources and utilization, institutions and policies
- Identification of specific environmental problems in the coastal zone
- Continuous inventory, monitoring and assessment of coastal zone components
- Establishment of a system of coastal zone data storage and retrieval
- Development of coastal zone management expertise in the country
- Organization of training programmes, fora and symposia where relevant issues in coastal zone management are discussed
- Dissemination of information about the importance of the coastal zone through an environmental education approach
- Rehabilitation and development of coastal resources and features
- Investigation of non-productive coastal environments
- Formulation of guidelines and legislation for the implementation of the coastal zone management plan
- Delineation of the responsibilities of government agencies related to coastal zone management

Source: NEPC (1983)

Table 7.3 **Options for Delineating the Ocean and Inland Boundaries of a Coastal Zone or an Ocean Management Area**
Source: Sorensen and McCreary (1990)

Increasing Jurisdictional Area →

Inland Boundary Options ↓ / Oceanward Boundary Options →	Mean low tide (MLT) or mean high tide (MHT)	Arbitrary oceanward distance(s) from a tidal mark	Boundary between provincial or state jurisdiction and national jurisdiction*	Ocean boundary of the territorial sea* (usually between 3 and 12 n.m. from CB) †	Ocean edge of the continental margin or shelf**	Ocean boundary of the exclusive economic zone (EEZ) ††
Arbitrary distance(s) from a tidal mark (such as 200 meters from low tide)	Costa Rica (MLT)	Sri Lanka Brazil Israel	California (from 1972 to 1976)	Spain	Great Barrier Reef Marine Park Authority	Sri Lanka, Netherlands, and Sweden ocean management program
Inland boundary of local government's jurisdiction***	Western Australia (MHT)		State of Washington (for planning)			
Inland limits of lands on which adverse impacts may be generated			• U.S. Coastal Zone Management Act • California (since 1976)			
Inland limit of climatic influence						

Increasing Jurisdictional Area ↓

* In many cases the boundary between a coastal state (or province) and the national jurisdiction is the same as the territorial sea boundary line.
** In a number of places the continental margin extends oceanward beyond 200 nautical miles.
*** The inland boundary of local government's jurisdiction often extends further inland than the lands on which adverse impacts may be generated.
† The coastal baseline (CB) is a series of straight lines that interconnect coastal islands, headlands and promontories. It is used to map the oceanward boundary of the territorial sea and the exclusive economic zone.
†† The EEZ extends 200 n.m. or to the oceanward limit of the continental margin, whichever is greater.

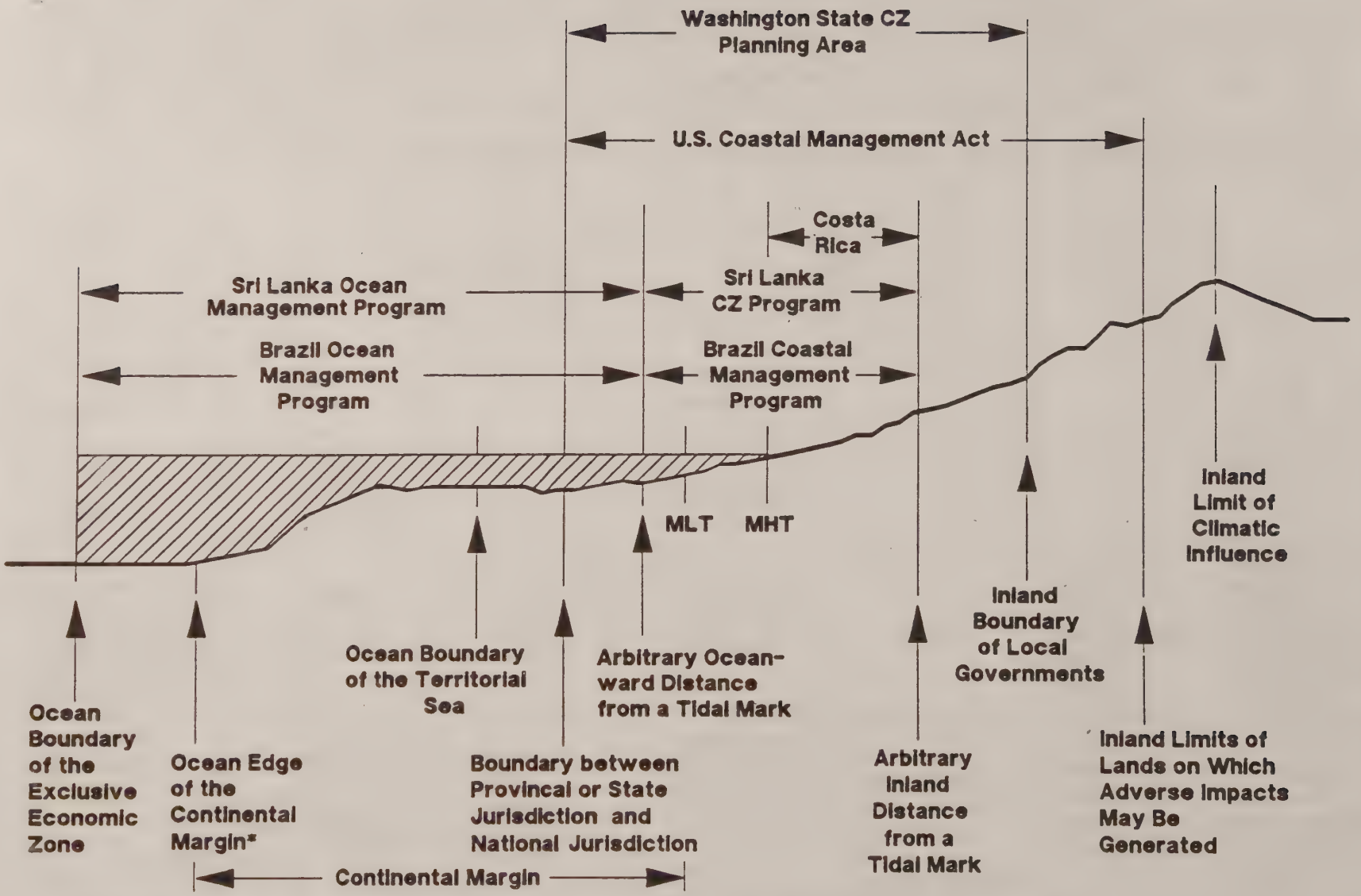

Washington State CZ Planning Area
U.S. Coastal Management Act
Costa Rica
Sri Lanka Ocean Management Program
Sri Lanka CZ Program
Brazil Ocean Management Program
Brazil Coastal Management Program
MLT
MHT
Inland Limit of Climatic Influence
Inland Boundary of Local Governments
Ocean Boundary of the Territorial Sea
Arbitrary Ocean-ward Distance from a Tidal Mark
Ocean Boundary of the Exclusive Economic Zone
Ocean Edge of the Continental Margin*
Boundary between Provincal or State Jurisdiction and National Jurisdiction
Arbitrary Inland Distance from a Tidal Mark
Inland Limits of Lands on Which Adverse Impacts May Be Generated
Continental Margin
* In a number of places the Continental Margin extends oceanward beyond 200 nautical miles.

Figure 7.3 *Existing and Potential Boundaries of Coastal Zone Management Programmes and Ocean Management Programmes*
Source: Sorensen and McCreary (1990)

BOX 7.7 - A FOUR-TIER MANAGEMENT SYSTEM FOR THE COASTAL ZONE

The following tiers are used to subdivide the coastal zone into management sub-units that are compatible with existing natural and jurisdictional boundaries:

Tier 1) Marine and coastal waters - The open water part of the coastal zone beyond the transitional area of wetlands, tide flats, etc.; permanently submerged resources. High level of central government interest and authority.

Tier 2) Transitional area - The edge of the sea which is intertidal may include coastal lowlands subject to flooding during seastorms as well as intertidal mangroves, tideflats and beaches. Central government interest; high level of interest regionally and locally.

Tier 3) Shorelands - The lands directly adjacent to the transitional area which generate significant impacts to coastal resources; high value for many purposes; urban waterfront development usually disrupts the edge zone and generates pollution. High level of local interest.

Tier 4) Uplands - A fourth tier should be added to include "uplands", if the ICZM programme is designed to address the effects of watershed clearing and soil erosion, pesticide or herbicide runoff, and alterations of hydro-period caused by dams and reservoirs.

Source: *Clark (1980)*

An expanded, more elaborate, version of the management-tier system is shown in Box 7.8. In this seven-tier system, three additional areas are distinguished - coastal flood plains, lagoons and estuaries, and the EEZ. The additional subdivision allows for a more focused and more flexible programme format. But Chua Thia-Eng (pers. comm.) warns that "One should not lose the holistic aspect" because the interactions between tiers may be very important in the management strategy, particularly where the programme is issue- oriented and aimed at reducing adverse impacts.

7.10 Regional Units

In the regional approach, specific "Regional Units" would be selected for customized planning and management programmes created specifically for the conservation, economic, and social needs of particular coastal regions. A regional unit might be a particular bay, estuary/lagoon, or commercial port and its surrounding communities and land resources. Or it might be a stretch of coast including beaches, coral reef and lagoon, and surrounding villages and resorts. Or perhaps, an island and its aquatic surroundings.

Specifically, the national ICZM programme can be organized to implement individual regional unit programmes, if it has the flexibility to recognize regional distinction. The national programme should be organized to facilitate regional economic development planning activities (Clark, 1990). Case studies of attempts at regional unit implementation of ICZM are shown in Box 7.9. However, not all attempts succeed; for example, refer to Canada's experience in Section 7.3 and Box 7.9.

7.11 Protected Areas

Protected areas as well as regulatory components are necessary for effective coastal and marine integrated programmes. Protected areas provide custodial protection for areas of special resource value. The protected area component can be facilitated by regulations which address both generic types of habitat of widely recognized biodiversity value (e.g., all mangrove forests or all coral reefs) and specific sites identified as "environmentally sensitive" (e.g., a particular lagoon, coral reef, or coastal lowland forest) for which site boundaries can be drawn.

An example of alternative approaches using protected areas is the Australian State of Western Australia where the ICZM strategy is to keep the land adjacent to the edge of the sea in a State Reserve and not "alienate" it for private purposes. The effect of this linear coastal reserve is to provide a buffer strip (of undeveloped public land) between the high water line and the developed part of the shorelands (O'Brien, 1988). In this manner, development does not crowd into the "edge zone", site of some of the most valuable of coastal critical areas (see Principle 4).

BOX 7.8 - A SEVEN-TIER MANAGEMENT SYSTEM FOR THE COASTAL ZONE

1. Upland areas of major influence;

2. All coastal lands subject to storm flooding by the sea;

3. All intertidal areas of mangrove, marsh, deltas, salt flats, tideflats, and beaches;

4. All permanent shallow coastal water areas such as bays, lagoons, estuaries, deltaic waterways, and nearcoast waters that include seagrass meadows, coral reefs, shellfish beds, and submerged bars;

5. All the sovereign nearshore coastal waters (territorial waters), usually to a distance of 12 miles offshore;

6. All small coastal islands and offshore reefs; and

7. The country's declared Exclusive Economic Zone (EEZ).

BOX 7.9 - REGIONAL ICZM PROGRAMME INITIATIVES

CASE STUDY

Mexico: The State of Yucatan, Mexico, has developed an ICZM-type plan for management of its coastline (Rafael Robles, pers. comm.). Major goals are to control coastal tourism development, create sustainable occupations for Yucatecans, reduce conflict, and improve the development and the conservation process. A "Plan de Manejo Integral de la Zona Costera" has been created for Yucatan, cooperation of the Federal Government has been assured, and the programme is now moving into the implementation phase. The plan combines regulatory control with designation of protected areas.

SE Asia: In a trial programme of great interest, the Association of Southeast Asian Nations (ASEAN) operating a coordinated series of regional-unit ICZM pilot studies, one in each of the six ASEAN countries. The idea was to start with prototype regional units in hopes that these would show enough promise to encourage the individual countries to implement nationwide ICZM programmes or, at least, to attempt more regional unit programmes within each country. The project was funded by USAID and operated by the International Center for Aquatic Living Resources Management (ICLARM) in Manila.

Canada: Canada's experience with the Regional Unit approach did not work out well. In fact, Hildebrand (1989) states that "the momentum for a nationally coordinated CZM programme was lost" in disagreements over administration of a federal provincial agreement for the Fraser River Estuary (British Columbia, Canada) unit programme (see section 7.3 for more details).

7.12 The Special Case of Fisheries and Aquaculture

Of the greatest economic importance is maintaining the productivity of fisheries and aquaculture. Continued fish production means continued livelihood for fishermen and for others in the fishing industry, including boat builders, trap and net makers, packers, distributors, and retailers - all of which enhances social, cultural, economic, and political stability. Of particular importance, a strong domestic fishery promotes self- sufficiency and reduces the outgo of foreign exchange. Compatible aquaculture can also improve the jobs and foreign exchange situation (Table 7.4).

As previously mentioned, ICZM-type programmes are less involved with control of fishermen or fisheries harvests and more with habitats of fish and shellfish and water suitability. Because the typical fisheries management role is not so likely to be subsumed by ICZM, the coastal management programme is often a collaborative venture working in cooperation with the fisheries authority. However, the author's opinion is not unanimous; some authorities see regular fisheries management as being undertaken "under the general framework of ICZM" (Chua Thia-Eng, pers. comm.).

A primary interest of coastal fishermen in ICZM is its potential role in the conservation of critical habitats (e.g., wetlands, and coral reefs) and protection of water quality. There will be a much closer connection between ICZM-type programmes and the small-scale, artisanal, fisheries than with the more industrialized offshore fisheries, because the artisanal fisheries are conducted in near-coastal and lagoonal/estuarine waters where the ICZM programme would be most relevant.

In aquaculture, the role of ICZM is more direct because aquaculture usually requires the conversion of land and water areas, a habitat issue. Grow-out pond construction, for example, usually requires conversion of natural coastal lowlands or mangrove forests to open water impoundments. If aquaculture expansion is not controlled, the long term consequences of habitat conversion may be to reduce the natural reproduction of species used in aquaculture, as well as reduce other natural values and contribute to pollution of shallow coastal waters. The presently favoured management response to requests for additional construction of ponds is to recommend against expansion if intensification of use and increased production from existing ponds is feasible (Snedaker et al., 1986).

With assistance from USAID, Ecuador is developing an ICZM-type programme called a "Coastal Resources Management Programme" (CRMP) which has as a main element, and major motivation, the control of coastal shrimp aquaculture. The enormous Ecuadorian aquaculture industry has pre-empted much of the mangrove forest along the coast and the natural production of young shrimp needed to stock the grow-out ponds has been depleted. CRMP is proposed as the management and planning approach best suited to control the expansion of the industry and, at the same time, to accomplish other needed management functions (Box 7.10).

Table 7.4. Social Feasibility of Coastal Aquaculture. Source: Smith (1984)

Social Feasibility of Coastal Aquaculture

In the context of working with coastal communities to develop appropriate aquaculture systems, the following aspects of community structure and institutions appear to be the most important:

- informal and formal institutions, especially those of a legal nature that govern property or use rights;
- sources of wealth (productive assets) and degree of concentration of ownership;
- male and female labour use patterns and availability;
- extent of collective action and strong leadership;
- previous experience with and reaction to technological change in aquaculture or other community activities;
- present skill levels, both technical and managerial; and
- extent of linkages with external institutions, including credit, extension and markets.

In most instances, technology is a two-edged sword. While it can potentially liberate and add to general community welfare, it frequently does so at the cost of established socio-cultural values, community structures and institutions. 0In the case of coastal aquaculture, however, two major factors must be kept in mind with respect to this issue:

1) The vast majority of residents in coastal communities are desperately poor. They are poor because of their lack of access to alternative employment opportunities and because existing community and national structures and institutions most often allow local elites to capture the bulk of any benefits that come from more productive tech-nologies introduced to or adopted by such communities.

2) The common-property nature of the coastal zone's resources, especially mangrove areas, is being rapidly eroded by the conversion of much of these areas to private fishpond use. This use and misuse of the coastal zone is made possible through subsidized financing and institutional arrangements that favour the large-scale private or corporate investor over the small-scale, perhaps communal, investor.

The above two factors imply that for the majority of residents in the coastal zone there is nothing particularly beneficial in existing community power structures and institutional arrangements. Most often, those communities have experienced only the negative aspects of this technology; for example, in the form of large-scale trawlers that have led to the over-exploitation of many coastal fishing grounds. What has been missing in much of their experience to date with technological advance is an element of community control over its development and use.

Participatory development on the part of coastal communities will require conscious efforts to involve them in the process of aquaculture development; it certainly will not come about without efforts to decentralize control and decision-making over the coastal zone itself and the technologies that are appropriate there. Nor will participatory development come about without efforts of interested researchers, extension workers, rural bankers and non-governmental community developers to make certain that communities are directly involved and supported over the long term.

BOX 7.10 - ECUADOR'S PROPOSED COASTAL MANAGEMENT PROGRAMME

CASE STUDY

Ecuador's Coastal Resources Management Programme (CRMP) began in March, 1986, when USAID selected Ecuador as the first of three countries in which to start a pilot project on integrated management of coastal resources. The Coastal Resources Center of the University of Rhode Island (URI) and the Office of the Environment in the Ministry of Energy and Mines (DIGEMA) in Ecuador were chosen to implement the project.

Ecuador's future economic development in large measure depends upon how its coastal ecosystems are utilized and managed. It is of the utmost importance that the resource base of agricultural products, lumber, fisheries and cultured seafood is not needlessly degraded.

The seven proposed components of the programme (as of August 1988) are as follows:

1. Form a Ranger Corps to improve enforcement of existing statutes;

2. Designate special management zones and create a decision-making body for each;

3. Create advisory committees in each management zone comprised of citizens and local and regional government entities;

4. Establish in Quito a simple structure to provide high level governmental support to the CRMP programme;

5. Establish a public education programme to show the people the importance of coastal resource management;

6. Establish a research programme on coastal issues, and;

7. Develop a training programme for all levels of participation in coastal resources management.

Source: URI (1989)

7.13 Traditional Management and ICZM

The effectiveness of "traditional" conservation, such as fisheries management, at the local level (by villages, tribes, etc.), has been recognized recently in studies in Nova Scotia (Canada), Brazil, Palau, Solomon Islands, and elsewhere (Principle 14); but there is little experience with incorporating traditional conservation into broad ICZM programmes. However, enough thought has been given to the subject as to how it could fit under the umbrella of ICZM.

Presently, the best approach appears to be the establishment of designated marine protected areas with joint authority between the local village or tribal governing unit and the national government. With the traditional conservation area set aside as a protected area, rules of access and resource use can be formulated to give priority to the traditional users. In this situation, where the traditional group has exclusive, or priority, access to the resource, more care may be exercised in the quantity of fish or shellfish removed, abstinence may be practised during spawning periods, and less destructive fishing methods may be used. In some cases, this will provide for better conservation of fishery resources than nationwide, centrally operated, management. But a combination of the two approaches might give an even better result.

A second approach is to designate the subject area as an ICZM regional unit and protect its resources through regulations and guidelines (the "regulatory" approach). However, the custodial approach (parks and reserves) might work better because the management authority would actually own the area - proprietorship generally confers a higher level of autonomy than regulation through the "police power" of government. The central government keeps some control by "leasing" the area to local authorities; the lease would be revocable for cause. The optimum arrangement would be to fit the custodial, protected areas, approach into a general ICZM regional programme (see Box 7.11.)

It should be noted that the major result of officially recognizing traditional (or "customary") conservation in an ICZM-type programme will be to convert public property rights, "the commons", to village or tribal property rights. This can be accomplished by a variety of techniques for transferring property use rights, such as designating the fishing area as a "resource reserve".

7.14 Research Needs

National research capacity is required to: 1) understand ocean and coastal processes, their relationship and impact upon the resource endowment; 2) evaluate, develop and conserve the resource endowment; 3) evaluate safety and environmental protection requirements in the marine areas as well as those related to the protection of life and property in the coastal areas; 4) evaluate information needs for monitoring the effects of present and planned activities on the marine and coastal environment; 5) assess new or improved technology to support coastal area and EEZ surveying, mapping, and research programmes; 6) develop approaches for multiple uses, and identify and resolve potential and current conflicts between the various users of coastal seas; 7) establish management structures for planning and coordinating the development activities in the coastal zone, including the EEZ; and 8) develop a regulatory framework and coordination machinery needed to implement a national ICZM plan.

BOX 7.11 - ASSESSING "TRADITIONAL MANAGEMENT" OF FISHERIES

A Commonwealth Science Council report recommends the following guidelines for the assessment of traditional fisheries:

- adaptability of traditional systems in the face of changes in perception, technology and society;
- the place of traditional knowledge in society - its role in social status, and differing sex roles;
- responses to commercial development;
- adaptability of traditional fisheries management regimes;
- effective means of obtaining and recording traditional knowledge;
- definition of traditional fisheries;
- clarification of nature of coastal resource use rights;
- social unit(s) on which rights are based;
- principles of boundary delimitation;
- allocation and transfer of coastal resource use rights;
- procedures for sharing of resources with outsiders;
- traditional conservation practices; and
- dispute resolution mechanisms.

Source: SPREP (1985)

7.15 Mobilization of Financial Resources

Lack of financial support at national and regional level hampers the management of ocean and coastal resources in developing countries. Protection of resources and adoption of more "responsible" development schemes for long term benefits may have immediate costs which developing countries might not be able to afford. Therefore, the promotion of ICZM in developing countries might best be in the form of a programme which utilizes some proportion of financial support from international funding agencies. But, still the ICZM programme must be founded on the national economic planning of coastal states.

Funding sources need identifying and proper funding procedures should be promoted. In particular, national sources should be identified (fees, fines, taxes, rents) and short-term financing cycles by donors should be replaced by medium to long-term cycles. Various international banks and donors should allocate a significant share of the funding they provide for pre-investment studies and better coordinate their interventions among themselves.

Conservation-oriented investment opportunities in coastal seas, including environmental rehabilitation, should be identified and encouraged as a useful complement to development-based funding, particularly for innovative resource developments. International organizations and donor agencies have a major role to play in mobilizing finances for ICZM managed coastal seas development and in formulating optimal revenue-generating systems. Excess funding should be diverted away from overinvested extractive industries into creation of alternative employment opportunities.

8. IMPLEMENTATION: SOME MANAGEMENT MECHANISMS

The conservation/environmental management approaches suggested below are keyed to facilitating economic development while preventing unnecessary loss of resources.

8.1 Pollution Control

In most countries, a pollution control authority has been established and is operating. Such an authority will retain continuing responsibility for pollution, and ICZM should coordinate with that authority regarding conformance of development projects with national pollution standards. In this role, projects with unacceptable potentials for pollution would be discouraged or modified to acceptability and conformance with standards.

ICZM programmes should focus on special coastal pollution sources not presently addressed, perhaps those caused by watershed disturbance and runoff and, especially, those that affect critical habitats. Of particular concern is sediment runoff from construction sites, farmlands, forest-cutting and land-clearing operations. Also, pollutants flushed by storm runoff into coastal waters can create toxicity (biocides, oil wastes, etc.) and bring excessive nutrients (fertilizer, animal wastes).

It should not be surprising that pollution is at its worst in the harbours of large coastal cities and industrial ports. Whether the pollution is from oxygen-depleting organic waste (e.g., sewage) or from toxic industrial wastes, it is damaging to coastal environments and resources as well as a risk to human health. Therefore, harbour projects should be intensively studied in the project review element and a maximum of conservation safeguards employed.

Control of land-based pollution is very complex. It requires major changes in agricultural and industrial practices, as well as the development of waste treatment technology, according to the IUCN draft world conservation strategy (IUCN,1990). The main changes needed are stated to include: comprehensive control of sewage discharges; reducing runoff of fertilizers and livestock wastes from agricultural land through the adoption of high standards of land husbandry; and limiting industrial effluents through more efficient use of resources. Special attention should be paid to controlling industrial wastes and improving sewage treatment to reduce risks to public health from consuming seafood and bathing in contaminated water (IUCN, 1990).

Another pollution source of particular relevance to ICZM is oil pollution that originates during exploration, production and transportation phases of the oil industry. Chua and Charles (1984) emphasize that: "In recent years, oil pollution of the marine environment has been an issue of considerable national and international concern". The deleterious effects on the marine environment and the living resources as a result of growing frequency of oil spills have caused public awareness and widespread political attention. It is interesting to note that of the total budget of petroleum hydrocarbons introduced into the oceans, 34.9% arise from marine transportation, 26.2% from river runoff, 9.8% each from natural seeps and atmosphere rain, 4.9% each from urban runoff, industrial and municipal waste, while oil refineries and production account for only 3.3% and 1.3% respectively. The total contribution

from offshore oil production in terms of blowout of oil-wells or leakage from producing sites is reported to be relatively insignificant (Chua and Charles, 1984).

Coastal waters are particularly susceptible to pollution where they receive the outflow of streams and rivers in lagoons or estuaries. It should be noted from the above that 66% of oil entering the sea is from marine transportation or local runoff, two sources of particular relevance to ICZM programmes. It can be presumed that this relative ranking (for Eastern Peninsular Malaysia) would apply to many countries with the same habitat types and could be used for guidance in ICZM programmes until specific data are collected for the country. But slick trajectories for spills at sea have to be calculated for each country and each section of coast separately.

8.2 Critical Areas

It will be most helpful in ICZM programme development to identify the special coastal habitats that should be given a high degree of protection. Detailed information on them should be available to all interests, particularly to resource users like fishermen, the public and the private development community. It should be recognized that, in the administrative context, there are three important types of critical areas:

1. Generic types of habitats that are widely recognized as highly valuable and that should be given a high degree of protection through regulatory mechanisms - wetlands, seagrass meadows, coral reefs, species nesting sites. All should be mapped and publicized. In the ICZM process of project review, developers would usually be told to avoid these types of habitats; therefore, developers should be informed ahead of time (before they design projects) that restrictions exist. In addition to ecologically critical areas, other types of areas should be identified, such as sand dunes (which stabilize beaches) and flood-prone lowlands (those that are regularly flooded) both of which would be included in the natural hazards prevention category.

2. Specific sites that are identified as critical areas would be identified for special regulatory protection. These would include certain specific (named) lagoons, estuaries, islands, mangrove forests, river deltas, coral reefs, etc. Each would be described, mapped and announced for the knowledge of all interested parties. The ICZM authority would strongly constrain development in these site specific habitats. As "red flag" areas, they would receive special analysis in the development review process.

3. Protected areas would include those of the critical areas that need the additional safeguard of the type of custodial protection that is awarded to national parks and nature reserves; these might best be assigned to the country's existing conservation agency.

In most countries, protection of generic habitat types and specific critical areas are not being attempted in a systematic way and ICZM intervention could be beneficial.

In practice, the identification process would proceed in the following order: 1) identification of generic habitats to be given protection nationally (regionally, if a regional ICZM programme); 2) delineation, listing and evaluation of sites that qualify as

environmentally sensitive sites (ESS) and that would receive special regulatory attention; and 3) select from the list of ESS, those that should receive the highest level of protection through custodial means as (custodial protection implies that the government has title to the area under protection).

An area would be categorized as "environmentally sensitive" and listed as a critical area if: 1) it contained an outstanding example of one of the generic habitats, or 2) it contained two or more of the critical habitats that individually were not outstanding but in combination created a major coastal or marine ecosystem, or 3) it had other outstanding characteristics. The result would be a single integrated set of critical areas for the entire coast which then would be sorted out for protection for either: 1) regulatory protection under an ICZM approach or 2) custodial site protection under a parks and protected areas approach (see next subsection on protected areas).

The process explained above has analogues in some ICZM planning and management programmes, although the terminology may differ. For example, the Puerto Rico ICZM has a system that is very close to the above, as shown below (NOAA/CZM, 1980):

1. Generic Habitat Types: all mangrove forests are included in a "Special Planning Areas" category.

2. Specific Sites (Critical Areas): numerous bays, lagoons and other coastal features are included in a list of site specific "Special Planning Areas".

3. Protected Areas: numerous coastal areas of exceptional natural value are identified as potential "Natural Reserves".

Habitats identified as critical areas may provide sanctuary to: 1) valuable species during vulnerable phases of their lives (shrimp, seabirds, fishes); 2) endangered species (whales and turtles); and 3) migratory species (waterfowl and wading birds). These habitats are used for feeding and spawning, as nurseries, and for shelter. Safeguarding these critical marine habitats by designating them protected areas can help conserve species, maintain fisheries, and support tourism.

8.3 Biodiversity

An important motivation for designating critical areas is to preserve biodiversity - particularly for species and the habitats of species that have been designated as especially valuable or in danger of extinction, such as, certain endangered birds, turtles, and marine mammals. These designations may be done in response to an international treaty or by independent national action. In addition to habitat management, there may be other appropriate actions to be taken under the ICZM programme; for example, banning exploitation of the species.

An example of a critical habitat for fishes and shellfishes is the mangrove forest. ICZM attempts to prevent obliteration of mangrove forests by constraining excessive mangrove clearing and other destructive development activities which are unreasonable and have a long term net negative effect on biodiversity, the coastal economy and the welfare of coastal people.

8.4 Protected Areas

The most certain way to conserve biodiversity and protect critical areas is to acquire ownership, or just assert ownership when the areas are already owned by government. In most countries, owners of proprietary rights (whether government or private) have the right to determine the way their land or water areas are used, including the right to deny access.

Government ownership and designation for protection offers the highest assurance that a particular area's resource values will remain intact and is universally the way by which parks and other protected areas are formed and made secure. Most simply, if the government owns a resource, on behalf of the people, government can dictate the use of that resource. Therefore, government can set aside for resource protection - as parks, reserves, refuges, or sanctuaries - whatever areas it owns. This implies that proper, and sometimes costly control and surveillance systems are put in place. Properly designated areas can provide for a variety of uses allocated through a zoning scheme. This concept is embodied, for example, in the conservation programme of the Great Barrier Reef Marine Park Authority in Australia.

Clearly the system of protected areas will be more effective if it is addressed by the ICZM programme. Conversely, protected areas planning is essential to the full development of a country's ICZM programme. Recognizing that coastal and marine protected areas must be considered in the broader context of a general programme for coastal and marine resources, it is suggested that an "umbrella programme" for conservation of renewable resources be considered. This umbrella programme would encompass the following:

- Limiting, as necessary, particular exploitative uses of coastal and marine waters and their resources or of linked areas that influence life in these waters (for example, preventing the mining of living coral reefs to maintain their value to fisheries and to protect the coast from natural hazards);

- Protecting particularly vital parts of coastal or ocean ecosystems (for example, critical habitats [ESS]);

- Restoring earlier conditions (for example, closing areas to enable the recuperation of damaged habitats or depleted stocks, or prohibiting activities that are physically damaging or polluting);

- Obtaining and transferring information (for example, through research, education, and interpretive programmes).

Creating coastal and marine protected areas (under government custody/ proprietorship) can help achieve practical development goals. These areas can be designed to support multiple use and to promote sustainable utilization, whereby resources are used but not used up. Properly selected (Box 8.1) and designed protected areas provide for a variety of uses and use controls in an integrated resource management scheme (Salm and Clark, 1984).

Designation of protected areas need not prohibit all uses, but rather only those which are incompatible with the primary purpose of the area (Salm and Clark, 1984; Hayes, 1985).

BOX 8.1 - SELECTION OF AN AREA FOR PROTECTED STATUS

A study by the United Nations Economic and Social Council (UNESC) lists the following reasons for selecting an area for protected area designation:

1. It is typical of an important ecosystem or habitat type;
2. It has high species diversity;
3. It is a location of intense biological activity;
4. It provides a critical habitat for commercially or ecologically important species or groups of species;
5. It has special cultural values (historical, religious, or recreational);
6. It is important for research purposes;
7. It is an area of special sensitivity particularly susceptible to damage or disruption;
8. It is an area significant for biotic character of species representation (i.e., an area with rare, threatened, endangered or endemic species); or
9. It is an area of exceptional human use value, such as a recreational or fishing area.

Source: UNESC (1987)

8.5 Natural Hazards

In many of the more densely populated nations, the risks of natural disasters to inhabitants of the coastal lowlands are rising because of population increases, migrations to the coast, and poorly planned development projects. Coastal people become more susceptible to natural hazards such as floods, typhoons, or tsunamis when land reclamation projects encourage settlement endangerously low-lying areas, or when land-clearing and construction removes protective vegetation, reefs, or sand dunes (Sorensen and McCreary, 1990). A particularly disastrous example is Bangladesh where hundreds of thousands of people were victims in major cyclonic sea storms.

Hazards loss reduction begins with preservation of coastal landforms that provide natural resistance to wave attack, flooding, and erosion from hurricanes and storms. These landforms differ significantly around the world. Human activities that remove or degrade protective landforms - for instance, by removing beach sand, weakening coral reefs, bulldozing dunes, or destroying mangrove swamps - diminish the degree of natural protection the coast affords. For example, if dunes are removed by sand mining or because of obstruction to ocean views, the risk to coastal development behind the former dunes is greatly increased. Similarly, mangroves, serve to dissipate wave energy and to stabilize the land areas behind them from the erosive forces of storms (Clark et al., 1980).

The value that these natural resources have for hazard prevention reinforces the need to identify them as critical areas and provide for them strong measures of protection as was done in Western Australia (O'Brien, 1988). Some common elements of resource conservation and hazard mitigation include (Clark, 1987):

1. Both require integrated approaches and centralization of authority in order to control the location and type of development.

2. Both require preservation of the natural elements that protect coastal populations from cyclonic winds and storm surges, e.g., mangrove forests, sand dunes, beaches, and coral reefs.

3. Both require management of coastal watersheds and river basins; e.g., in order to protect municipal water supply and coastal water quality and to reduce coastal flooding damage.

4. Both require involvement of many levels of government from national to local, as well as international cooperation, in some instances.

In the ICZM context, the following two management measures are the most important for natural hazards management:

- Conserve protective features: There is a need to safeguard to the maximum extent possible all the natural resources and features that protect the coast from storm surge and waves in high hazard areas (prohibit sand removal; avoid mangrove clearing; protect coral reefs, etc.).

- Establish a setback line: There is a need to delineate a coastal construction setback line landward of the "high hazard zone" and prohibit construction seaward of it (Table 8.1).

The conservation of protective features for hazard protection would be handled by the ICZM programme in the same manner as conservation of natural habitats. The setback line is somewhat complicated to calculate, as discussed below.

The ocean beachfront is a most hazardous place to build. Continued severe beach recession is certain and predictable along much of the coast. It is unwise to allow development of property that will surely be lost to the sea, especially when the security of buildings so often creates demands for groins, bulkheads, and other protective works, which may further imperil the whole beach system (Box 8.2).

Keeping development far enough inland to avoid the high risk zone is important in natural hazard prevention efforts. Therefore, a setback line should be delineated at a safe point inland from the beach and all construction kept behind this line. This planning solution is the concept of "retreat" which follows these steps:

1) Predict how far back the beach will erode in the future (say 50 years from now);

2) Identify this set back line on appropriate maps (calculated as shown in Box 8.3); and

3) Prohibit any building, or rebuilding, seaward of this line.

In another example, the ICZM authority might require a 50-metre buffer zone around the outer edge of a coastal wetland to prevent encroachment. Other examples of setbacks to prevent blocking the coastal viewscape or preventing pollution could be cited. Hazards loss reduction should begin with preservation of coastal landforms that provide natural resistance to wave attack, flooding, and erosion from hurricanes and storms. For example, dunes, beaches and wetlands protect coastal inhabitants and property against moderate storms and absorb some of the more violent energy of major storms.

An ICZM programme could be a good vehicle for combining coastal natural hazards prevention and resources conservation in the coastal seas. As many experienced planners and mangers already know, the measures best suited to conserving ecological resources are often the same as those needed to preserve the natural landforms that serve as barriers to storms and flooding (Clark, 1987).

Since the main threat to the beach is usually from development on land next to it, beach protection requires coordinated management of the itself and the land behind it, as well as a way to limit buildings, prevent excavation, and control beach protection and inlet structures.

Table 8.1 Shoreland Exclusion or Restriction Setbacks. Source: Sorensen and McCreary (1990)

COUNTRIES	DISTANCE INLAND FROM SHORELINE*
Ecuador	- 8 m.
Hawaii	-- 40 ft.
Philippines (mangrove greenbelt)	----- 20 m.
Mexico	----- 20 m.
Brazil	------ 33 m.
New Zealand	------- 66 ft.
Oregon	---------- Permanent vegetation line (variable)
Colombia	---------- 50 m.
Costa Rica (public zone)	---------- 50 m.
Indonesia**	---------- 50 m.
Venezuela	---------- 50 m.
Chile	---------- 80 m.
France	---------- 100 m.
Norway (no building)	---------- 100 m.
Sweden (no building)	---------- 100 m. (in some places to 300 m.)
Spain	---------- 100 to 200 m.
Costa Rica (restricted zone)	------ 50 m. to ---------- 200 m.
Uruguay	---------- 250 m.
Indonesia** (mangrove greenbelt)	---------- 400 m.
Greece	---------- 500 m.
Denmark (no summer homes)	---------- 1-3 km.
USSR - Coast of the Black Sea (exclusion of new factories)	---------- 3 km.

* Definition of shoreline varies, but it is usually the mean high tide. Most nations and states exempt coastal dependent installations such as harbor developments and marinas.

**Indonesia has both a 50 m setback for forest cutting and a 400 m "greenbelt" for fishery support purposes (see text for explanation).

BOX 8.2 - SAND MINING, EROSION, AND COASTAL MANAGEMENT PROBLEMS IN GRENADA, SAINT VINCENT, SAINT LUCIA, SAINT KITTS, DOMINICA, AND ANTIGUA

The three main problems common to all the islands are the mining of beach sand and in some cases aggregate also; the need for proper coastal development policies including setbacks, sewage treatment etc.; and finally the need to have one ministry or department with overall responsibility for the coastal zone.

The mining of sand and/or aggregate has been identified as a coastal problem in the islands of the East Caribbean previously. In all the islands there is legislation controlling sand mining; however, in many cases it is the Ministry of Public Works who has to implement this legislation and all too often it is that Ministry which is the greatest offender of the sand mining laws. In addition, there is always the problem of monitoring and implementation; in some cases this is carried out by the local village councils. Obviously beach sand mining should be stopped, but unless an alternative can be offered at a reasonable cost, this is not feasible. Nevertheless, viable alternatives for beach sand should be actively sought.

The other problem concerns coastal development. This has to be well planned incorporating knowledge of possible coastal changes. A coastline is not a static feature. In some islands there is no coastal setback policy, in other islands the setback is not sufficient for the extent of coastal changes. In view of natural erosion trends, in addition to man-caused erosion, setback policies must be implemented in order to conserve the coastal zone and to conserve the developments. A setback policy of 100 m on lowland coasts is recommended. Other aspects of development, especially waste disposal, have to be carefully monitored and controlled, changes in the beach zone are closely linked to changes in the offshore zone.

Finally, and perhaps most importantly, one Ministry or Department should have overall responsibility for the coastal zone. The actual Ministry varies from island to island, but unless one body has responsibility for the coastal zone, it is impossible to successfully implement a coastal policy. In most islands it is easy to distinguish which particular Ministry should have this responsibility.

Source: *Cambers (1985)*

The general goal for the management programme should be to maintain the beach profile by protecting both the natural processes that supply the beach with sand and the sand-storage capacity of the beach elements themselves. Meeting this goal will require careful examination of conservation needs, natural processes, building practices, and corrective engineering proposals that affect whole beach systems.

8.6 Restoration

Pollution, habitat conversion, and interference with water circulation, among other effects, have seriously reduced the economic and environmental benefits of most natural systems. While it is an important function of ICZM to constrain further ecological losses, it is also important to plan for the repair of natural systems damaged in the past.

If a wetland is covered with fill behind a concrete bulkhead, it is unrealistic to plan to restore it to its original condition; but if a wetland has been diked for rice culture or aquaculture, it would be relatively easy to reconvert it to a nearly natural wetlands condition.

If a coral reef has been damaged by pollution, hurricanes, mining, or boat anchoring, it may be difficult, but not impossible to rehabilitate it. The rehabilitation can be costly and the time of recovery very long, but for certain reefs of high value for tourism, fish breeding, or shore protection the investment could yield a high payoff (Clark, 1988).

Degraded dunes and beaches can be rebuilt. Mangrove forests can be replanted. Polluted estuaries can be cleaned up. The technology is well developed for most such restoration projects, following the "nature synchronous" approach (see Principle 9). It is usually only a matter of locating a source of funding, which may be difficult sometimes.

In summary, the ICZM programme should include an ecosystem rehabilitation work element. This will require an investigation of the condition of coastal resources, an economic evaluation of losses and benefits of rehabilitation, and recommended priorities for rehabilitation projects.

8.7 Project Review

A major purpose of ICZM-type programmes is to examine proposed major development projects to determine the impacts they have on coastal resource systems and to recommend design or location changes which can eliminate or reduce any negative impacts. Most probably the appropriate techniques would involve a permit system, whereby the development entity could not begin the project until a permit was issued by the ICZM agency (Figure 8.1).

This regulatory function will usually require some form of the "environmental assessment" type of fact finding procedure. If the impacts are eliminated or reduced to a minor level or if they are appropriately "mitigated" (i.e., offset by compensatory activity such as environmental enhancement elsewhere on or off the development site) the proponent of the project will be granted development permission. Over time, experience gained with different kinds of projects and different resources will raise the level of confidence of the ICZM programme and actually enable it to speed up development by providing useful strategic guidance to coastal communities and to development interests.

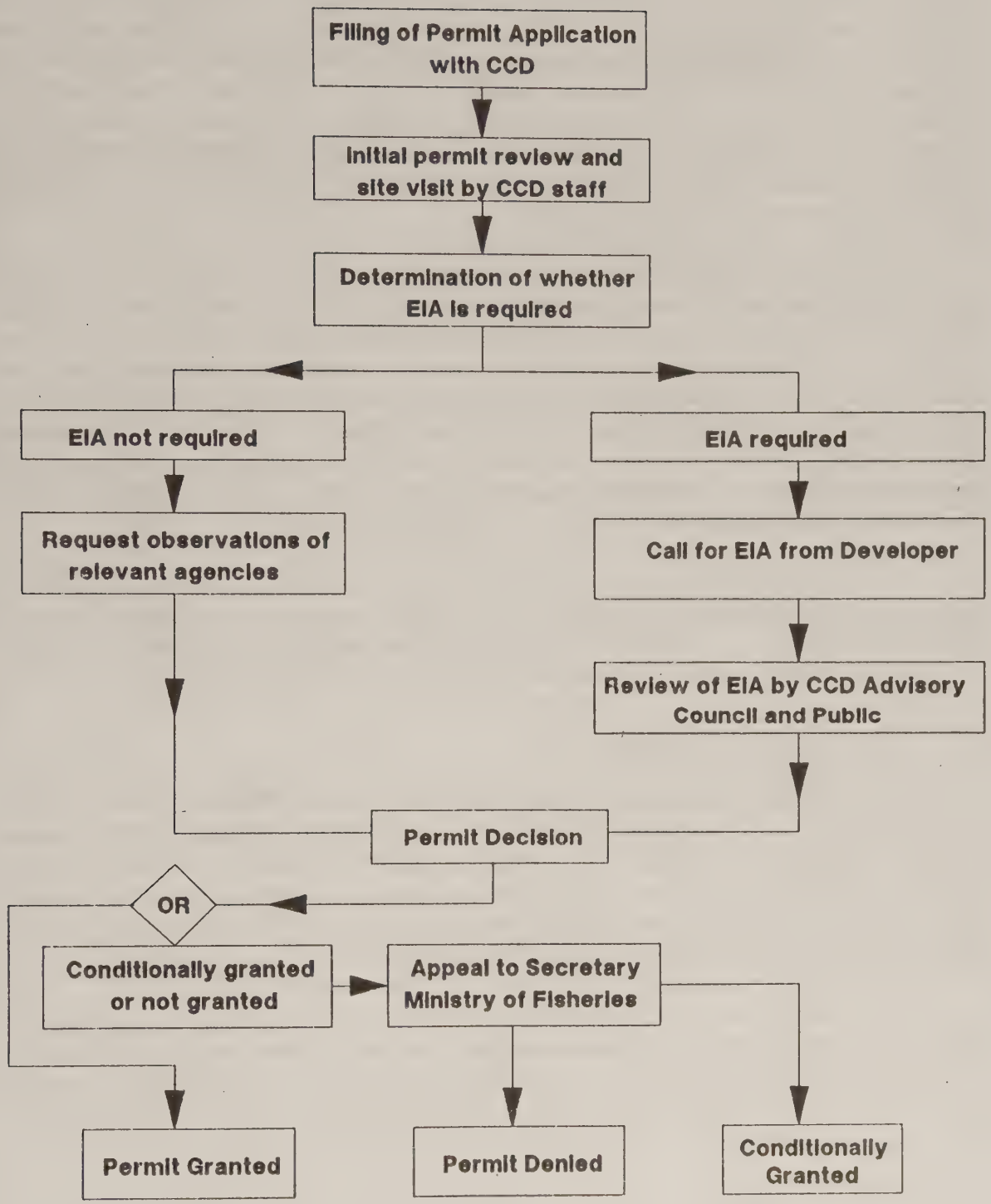

Filing of Permit Application with CCD
Initial permit review and site visit by CCD staff
Determination of whether EIA is required
EIA not required
EIA required
Request observations of relevant agencies
Call for EIA from Developer
Review of EIA by CCD Advisory Council and Public
Permit Decision
OR
Conditionally granted or not granted
Appeal to Secretary Ministry of Fisheries
Permit Granted
Permit Denied
Conditionally Granted

Figure 8.1 *Sri Lanka Coast Conservation Department Procedure for Reviewing and Issuing Permits. Source: CCD (1988)*

8.8 Environmental Assessment

At the centre of the development review and control process is the formal assessment of impacts predicted for specific projects - the "environmental assessment" (EA). The information and analysis generated in the EA provide the basis for the decision on whether a coastal project is approved as is, or approved with conditions attached, or not approved. EA is used to predict the environmental effects of a project or a programme, providing a systematic way to review coastal project impacts, to modify them to reduce negative impacts on resources, and to reject the worst of them. Lately it has become common to include economic and social considerations as part of the assessment. Nevertheless, it is still usually termed an environmental assessment (EA).

The process has been used for 15 years, and its principles, practices, methodologies, and limitations are well known (Box 8.3). Training in the field is easily available. Also there is a wide literature on EA (e.g., Burbridge and Maragos, 1985; Beanlands, 1985) some of which is most appropriate. Of particular value is a recent UNEP Regional Seas report (Jernelov and Marinov, 1990). Maragos et al. (1983), Thompson (1985), Ahmad and Sammy (1985), Beanlands (1985) and Gammon and McCreary (1988). However, special approaches may be needed for developing countries which cannot directly apply the guidelines created for developed countries. Chua Thia-Eng (pers. comm.) suggests that regional bodies be established to create EA guidelines appropriate to the region.

It is usually best to have two or three levels of assessment of increasing complexity; the first level is a preliminary review to see if there are potential serious impacts. If so, the project is subject to higher level, more intensive, assessments, as is done in the "AMDAL" EA procedure operating throughout Indonesia.

8.9 Socio-Economic Assessment

Economic and social impacts can be incorporated into the EA. Burbridge (1987) recommends that ecological and economic impacts be jointly evaluated. With increased perception of ecological functions, it is possible to improve the economic expression of their value to society. For example, mangroves, once considered worthless unless harvested (or made into shrimp ponds) are now seen as extremely valuable ecological resources showing the importance of balancing conservation and utilization.

Environmental impact and social impact are specially important considerations in planning regional development. A human ecology perspective takes into account traditional uses, rights, and special needs of tribal minorities. Migration and population expansion also must be considered (OAS, 1984). Regional development is premised on the concept of increased social equity (see Principle 10).

8.10 Conflict Resolution

Because the ICZM process operates at the interface between land and water, there is often intense conflict between private (or quasi-private) property-based operations in shorelands and public (common) property-based activities in the tidelands and coastal waters. Thus, the ICZM process may have an important mediating role between conflicting wetside

BOX 8.3 - SOURCES AND CATEGORIES OF IMPACTS

The sources of impacts are varied and are categorized and defined in different ways by different sources. The following distinctions are made:

1. Naturally caused impacts - Those derived from natural systems such as global temperature changes, hurricanes (typhoons), floods, diseases which usually result in the gradual or sudden death of organisms and in which man has had no discernible input.

2. Non-natural impacts - These are always somehow the result of human activities which have direct or indirect effects on ecosystems.

3. Direct impacts - Coral collecting, trampling, spear fishing, overfishing, speed boating, trail walking and tree cutting are examples that have visible immediate effects.

4. Indirect (or external) impacts - Inland terrestrial activities such as deforestation, improper soil coverage, the indiscriminate use of agri-chemicals all contribute to environmental degradation directly or indirectly on other coastal and marine systems.

5. Physical impacts - these can be natural or non-natural in origin, as well as direct or indirect and result in the physical alteration of a particular ecosystem, such as anchor damage, boat grounding on coral reef or eutrophication by sewage in a lagoon.

6. Ecological impacts - they may be a result of any of the above categories but pertain to a broader scale of changes with more long term effects and the possibility of permanent alterations to an ecosystem.

7. Socio-economic impacts - these are usually a result of a direct or indirect interaction with foreign visitors on local communities. These can result in changes in the habits of other resource users, competition for scarce resources and changes in social habits.

8. Technological impacts - Among many other impacts, is the introduction of new technology which may cause unemployment (retraining may be a solution).

and dryside interests. This essential role should not be played out sector against sector - rather, the mediating/coordinating entity must look at all sectors with legitimate interests to find the most broadly compatible solutions. The objective of the type of integrated planning used in the ICZM process is the preparation of a comprehensive plan in which the various development sectors are assessed for their effects on the various resources in a given geographic area (of which the coastal area is one of the most distinctive).

As an example, integration may be needed among fisheries, tourism, oil and gas development, and public works where these sectors are all attempting to use the coastal zone simultaneously (Sorensen and McCreary, 1990). Both fisheries and tourism depend to a large extent on a high level of environmental quality, particularly coastal water quality. Both sectors may receive "spillover" impacts such as pollution, loss of wildlife habitat and aesthetic degradation from uncontrolled oil and gas development. In another example, fisheries may require port services similar to those on which tourism depends, an infrastructure system that supplies water, sanitation, transportation, and telecommunications. Therefore, planning for both should be integrated with that for transportation and public works sectors.

It is also clear that the 30 or so developing nations in the humid tropics with extensive mangrove forests should have a strong incentive for integrated coastal resources management. Most developing nations with extensive mangrove forests are confronted with similar stresses which threaten the sustainability of this renewable resource. Conversion of mangrove forest to aquaculture ponds or croplands often presents a particularly difficult conflict of uses (Sorensen and McCreary, 1990).

9. INFORMATION, TRAINING AND EDUCATION

A full-scale programme will include many important information, education and training responsibilities, which would be handled by the planning unit of the ICZM programme (Box 9.1).

Often, the availability of information is not the main problem. In fact usually not enough use is made of available information from within the country, from ICZM studies in other countries, and from guidelines and other materials which attempt to provide information relevant to the management of the coastal zone. Also studies have been conducted in many countries on a great number of subjects related to ICZM and development planning in particular. The real challenge is to collate this information and to make effective use of it in addressing planning and management issues.

With an ICZM management unit reviewing development proposals and often requesting changes in project specifications, developers will soon find that they can benefit from prior consultation with ICZM staff. Also, a need for technical descriptions and guidelines will emerge. Consequently, the planning unit may find another role in providing a variety of technical consulting services to developers and other coastal interests.

9.1 Research and Information

This section discusses the priority types of information that should be collected and made available through the ICZM programme.

9.1.1 Data Base

Expansion of the data base available in most countries for management of coastal seas resources will be required. Technology for acquiring such information must be closely linked to plans for utilizing the coastal and marine areas. Likewise, requirements for data and specifications for equipment to acquire, manage, and analyse such data need to be defined in terms of specific user needs. Potential users should be made aware of data available and of technological developments for obtaining coastal seas data and for processing and interpreting such data.

National research capacity needs improving in most cases and certainly in developing countries, building on present capacity for fisheries and other national research laboratories, universities, etc.

Current mapping and resource characterization technologies and information systems available to developing countries should be assessed. Geographic Information Systems (GIS) will play a very useful role for data inventories and collection, promotion of data analysis, elaboration of synthesis and historical perspectives, monitoring coastal development and developing coastal degradation indexes.

BOX 9.1 - INFORMATION NEEDS FOR ICZM

The following are some principal types of information needed for ICZM:

1. Physical environment: terrain data (including history), erosional processes, storm surge, winds, tides, air-sea interaction, sediment transport, geological setting, subsidence, sediment supply, meteorological data, climate.

2. Biological environment: Primary and secondary production, distribution and extant of living marine resources, major habitats and ecosystems, ecological relationships that determine productivity, presence of rare, threatened or endangered species; indicator species.

3. Sociological information: Some important requirements include the following: resource dependency; historic use patterns including methods; factors determining historic use patterns; identify current use patterns; identify whether current use patterns are sustainable; demography; socio-cultural information; land and sea tenure.

4. Economics: Resources and resource use patterns should be given economic values. Qualitative values - resources and resource-use patterns that cannot be economically valued have to be considered. Specific economic pursuits that should be included in data collection are: fisheries, tourism, ports, energy, settlements, transportation, aquaculture, mining, oil/gas, waste treatment and disposal, settlements, cities, traditional practices.

5. Issues: It is necessary to identify the groups with a stake in the use and management of coastal resources groups and potential conflicts among them.

6. Institutional mechanisms (national, state, and local): ministries, departments with division of responsibility, organization and hierarchy; legislation on zoning, pollution, resource, utilization; interagency councils; advisory panels; standing agreements with private parties; permitting and other administrative processes to carry out legislation.

Assessment of the present status of coastal zones is required urgently, including diagnostics on eutrophication, occurrence of red tides, ciguatera, coliforms at beaches, nitrification and salinization of groundwater, fish abundance, habitat degradation levels, identification of local and upstream impacting activities (agriculture and others), wetland obliteration, etc.

9.1.2 Boundaries

Locating and mapping the boundaries of the coastal zone is one of the early tasks in ICZM planning. This would be fairly simple if an existing mapped boundary were used; e.g., the "25-year flood line", a coastal highway, or a topographic line such as 5 m elevation. Where a new boundary line has to be delineated with multiple specification, the task could be complex, particularly where a high degree of precision is required because of expected controversy of the kind that occurs whenever land-use zoning of any kind is done.

9.1.3 Resource Surveys

An important aspect is identifying, evaluating, and delineating generic critical habitats such as mangroves, coral reefs, dune fields, seagrass meadows, and species habitats, and buffer areas around them where appropriate. Hazardous areas such as coastal flood plains and high-hazard zones could also be described and delineated. Polluted areas would be located and mapped.

Another important survey job is identifying, evaluating and delineating: 1) specific "environmentally sensitive areas" to be "red-flagged" for regulatory protection, through the development project review process; and 2) areas to be recommended for parks, reserves, sanctuaries, refuges, or other protected areas status.

Additional survey work to be done includes advance identification of areas that are not ecologically critical habitats but if developed could cause especially negative impacts on coastal ecosystems, such as steep slopes with high sediment runoff potential.

9.1.4 Environmentally Sensitive Areas

The survey, mapping, and evaluation of resources can be a very important addition to an ICZM programme. It can identify in advance the most valuable, or critical, coastal habitats, ecological functions, tourist attractions, and places most subject to natural hazards damage. This information would be useful in the review and assessment of coastal development projects and in identifying candidate sites for coastal parks and protected areas. A survey would also locate highly polluted waters and degraded resources that need rehabilitation. Another benefit would be the location of optimal sites for future development activities.

9.1.5 Carrying Capacity

Carrying capacity analysis as a method of numerical, computerized calculation for prescribing the limits to development with cold objectivity, was initiated in the 1960s. It has not achieved much success in influencing government policy because of the complexity of the parameters, and because politicians and administrators are reluctant to have their judgement

pre-empted by a computer. Nevertheless, a non-prescriptive and more qualitative and normative concept of carrying capacity exists today and does influence tourism development (Clark, 1991a).

With carrying capacity, as with other biological analogies, the social dimension complicates the procedure for estimating limits (Dunkel, 1984). Some of the key components - such as tourist or user satisfaction - change when the users themselves or their preferences shift. Consequently, scepticism remains about the applicability of carrying capacity as a management technique and disagreement exists over-estimation methods (Dunkel, 1984).

Therefore, the actual carrying capacity limit - in numbers of visitors or any other parameter - is usually a judgement call based upon the level of change which can be accepted, regarding: 1) sustainability of resources, 2) satisfaction of resource users, and 3) the level of socio-economic impact (Clark, 1991).

9.1.6 Upland Effects

The planner needs to create strategies for reducing negative impacts from upland activities. It is important to know the degree to which, in the natural state, uplands terrain and hydrological systems - streams, ponds, wetlands - can hold and can detain large amounts of storm water, acting in effect as a natural sponge that holds water during heavy rains or snows for later, more gradual release. This provides an ecologically compatible rate of runoff flow as well as some protection against flooding for downstream communities. Uplands are also important in protecting coastal waters from storm runoff pollution because their vegetation and soils cleanse the water (Clark et al., 1980).

The beneficial functions of the coastal uplands are diminished when the terrain is cleared of vegetation, paved, or altered to accelerate drainage; when surface water bodies and watercourses are filled, detoured, or channelized; or when the natural flow pattern is significantly disrupted so that freshwater flow to the coast occurs in surges.

In a practical sense it will be most difficult for ICZM to obtain much influence over upland development activities because it is uncommon for those who plan dams or land clearing enterprise to consult with coastal interests. However, it is worth trying to review and comment on major upland projects (see Box 9.2).

9.1.7 Multiple-Use Management

In the coastal area, as elsewhere, some resources are more vulnerable to development impacts than others and some development types and uses are more threatening to resources than others. Information on these two aspects is useful to ICZM programmes, particularly categorizations which can be used in development project review and in multiple-use economic development planning. The simplest way to do this is by an approach in which:

- land and water areas are classified as - 1) approved for development, 2) not approved for development, or 3) approved for development under specified conditions;

BOX 9.2 - DOWNSTREAM EFFECTS OF LARGE DAMS

Rivers the size of the Usumacinta River in Tabasco, Mexico, control natural and human life for hundreds of miles downstream and most importantly where they spread into the wide plains of their coastal deltas. (The Usumacinta flows north across the Yucatan to enter the Gulf of Mexico at the Bay of Campeche.) Here, at the coast, the big rivers build, serve and rule the lowlands through hydrological, geological, and biological forces well known to science.

These forces deposit silt to build and maintain the natural levees which channel the rivers and provide the high ground for human settlement. They provide water flows in a regular seasonal pattern, or "hydroperiod", to which all the trees, wetlands, fish, birds, wildlife, and human endeavours are keyed. The mighty Usumacinta River ministers to 4.5 million acres of delta wetlands and lowlands.

When the natural hydroperiod is altered by upstream dams that divert water flow or hold it to be released on an artificial timetable the consequences may be severe, particularly to the downstream people of the Mexican states of Tabasco and Campeche, whose lives and fortunes are tied to the Great Delta Wetlands.

This natural complex is a major resource system on the Gulf of Mexico rim, containing Mexico's largest mangrove forest, its richest shrimp fishing grounds (the Bay of Campeche), and its premiere waterbird habitat. The wetlands also provide the major life support of the contemporary Mayan agrarian community of the Delta, including natural forage for their large herds of cattle.

The State of Tabasco is moving to conserve its part of the Great Delta Wetlands. In 1987, Governor Enrique Gonzalez Pedrero completed an intensive study aimed at creating a conservation plan for 700 000 acres as the "Centla Biosphere Reserve". Under the Centla Plan, nature and human life will coexist under an enlightened scheme of resource management, the hallmark of the Unesco-created biosphere reserve model.

- land and water areas are classified as - 1) approved for development, 2) not approved for development, or 3) approved for development under specified conditions;

- development project types are classified as - 1) acceptable, 2) unacceptable as designed and located, or 3) acceptable with changes in design and location.

This is a triage approach whereby the safe and unsafe can be dealt with expeditiously, and maximum effort can be applied to the in-between categories of either areas or development types. This type of simple classification would be an initial job for the planning unit; later, more sophisticated types of classifications might be generated (e.g., land suitability analysis).

Another facet of the same issue is multiple-use potential. Decision-makers need to know what economic and social uses can co-exist in an area and which cannot. In most situations the multiple-use approach should be advocated. In some situations, however, exclusive use should be recommended. The ICZM planning unit should be prepared to investigate compatibility and make recommendations for multiple- or exclusive use.

Burbridge (1986) makes a compelling argument for multiple-use strategies for coastal resources in demonstrating that a unique feature of the ecological systems of the coastal zone is the wide variety of functions they serve and the broad array of economic and environmental goods and services they provide . In the case of mangroves, over 70 direct and indirect uses arise from mangrove forests. In addition, the mangrove forest acts as a nursery, a feeding or spawning area for commercially valuable fish and shrimp species. These and other services cannot be replaced at a reasonable cost.

The following have been listed by Sorensen and McCreary (1990) as economic sectors identified by various countries, all of which may be addressed by integrated ICZM programmes:

- fisheries
- water supply
- recreation development
- tourism development
- port development
- energy development
- industrial siting
- nature protection
- agricultural development
- aquaculture development

Many of these uses could coexist in a multiple-use approach while others might not, or would have to be severely restricted. ICZM's role is to sort them out and recommend the optimal mix. For example, there is little problem in combining fisheries, tourism and water supply, but mixing port development and tourism with critical area protection (e.g., mangrove forests) may be very difficult. The role of the planning unit is to evaluate the effects of uses in combination in order to advise the decision-makers and managers.

9.1.8 Restoration/Rehabilitation of Resources

While not all coastal resources that have been lost can, in a practical sense, be returned to productivity, some of them can. Mangrove forests can be replanted, dikes dismantled, normal fresh water or tidal flows to wetlands restored, and coral reefs can be started toward gradual renewal. The ICZM planning unit should identify, through survey, the critical areas that have been degraded and can be repaired at reasonable cost and effort. These can be mapped, priorities assigned, and a strategy for rehabilitation created.

9.1.9 Environmental Assessment

As mentioned, a major task of the information function of ICZM is to conduct environmental impact assessments for particular projects under review. According to Maragos et al. (1983), the environmental assessment process is the mechanism by which the ecological and other environmental consequences of proposed development are estimated and recommendations provided to decision makers to reduce or avoid impacts. For coastal development, the major steps of the assessment process include:

- Data gathering on project alternatives and coastal resources to be affected, including existing uses of these resources;

- Estimates of the adverse environmental impacts likely to follow development;

- Identification of measures to reduce unavoidable impacts;

- Identification of designs, locations, and precautions to prevent avoidable impacts; and

- Recommendations to decision-makers on the best combination of measures and alternatives to minimize impacts.

Maragos et al. (1983) emphasize that most development involves several phases; preliminary feasibility studies; selection of a plan and detailed engineering and design; construction; operation; and decommissioning of facilities, if applicable. Throughout the assessment and planning process, there will be an accumulation of physical, ecological and other environmental information. In time this information normally progresses from general, qualitative, and extensive in character to detailed, specific and quantitative. Although qualitative information is invariably required for all types of development, the choice of alternatives to be implemented dictates to a great extent the need for quantitative information. Often the need for expensive quantitative data-gathering can be avoided if the project proceeds in a direction that minimizes adverse impacts.

An important role for ICZM entities is in public information and education. Informing the public as to the purposes and approaches of ICZM and the long term benefits to be gained from conservation is important. Holding local consultations and hearings is essential to the success of new initiatives that affect coastal communities.

9.2 Training

Staff training is essential in a field like ICZM where so many different types of activities and technologies are involved. Training would range from short courses and on-the-job training to formal university degree courses. International assistance is available to most developing countries to meet a variety of training needs.

In one example, the Coastal Area Planning and Management Division of Trinidad and Tobago (located in the Institute of Marine Affairs) listed its priorities for staff training in ICZM as: (McShine, 1985)

1) assessment of sociological impacts
2) assessment of economic impacts
3) cost benefit analysis
4) simulation analysis
5) resource management

Another type of training activity that is particularly important for ICZM programmes is orientation courses for decision-makers and agency staff in the various ministries or departments that are affected by ICZM. Seminars, clinics, field trips, and other dialogues will help these agencies to understand the ICZM programme and assure their cooperation. Lack of sufficient data and/or personnel trained in ICZM should not be seen as a barrier to the initiation of an ICZM programme. The shortage of people trained in coastal zone management or with detailed knowledge of coastal ecosystems is sometimes given as a reason why the ICZM process cannot be initiated. In practice there is normally sufficient manpower with skills in basic ecology, economics, planning and administration to support an ICZM initiative.

The basic requirement is for a small group of 10 to 20 persons from different disciplines to form the nucleus of an ICZM team. Staff from existing agencies can be assigned to this team on either a part- or full-time basis without undermining the normal work of these agencies. Additional manpower can be made available by placing emphasis in the ICZM programme on in-service training and recruitment of trainee staff who will attend ICZM courses before taking their appointments in government.

9.3 Raising Public Awareness

Public education is a prerequisite for successful implementation and management of marine and coastal resources. The most important goal of education in this setting is to convince people of the value of protecting resources for the long-term, sustainable benefits that protection can provide. Environmental education aims to provide the community with both information and an ethic so that its members can make informed decisions about the use of their resources (Clark, 1991 (a)).

Political and financial support is also dependent on the level of awareness of decision-makers. In educating politicians and economic planners, it is important to use language and concepts with which they are familiar. Carrying capacity studies that utilize cost-benefit analysis can produce figures such as estimates of revenue, sustainable yields, and other quantifiable data that can be used to convince decision-makers of the economic and social benefits of protecting ecosystems (Clark, 1991 (a)).

The first step in designing an education programme is to identify the various target audiences. Artisanal fishermen, dive operators, and tourists are examples of target groups found in marine and coastal settings. Next, specific educational objectives must be established in terms of knowledge, attitudes and behaviour to be changed or influenced within each target group. For example, the knowledge that a protected area can increase fish stocks and catches in nearby fished areas can lead to positive attitudes towards the protected area, and compliance with its rules (Clark, 1991 (a)).

This approach is being used by the ongoing CIDA Fishery Enhancement Programme based in Discovery Bay, Jamaica, which is encouraging a shift towards the use of larger mesh size wire for fishpots to improve the sustainability of the fishery. In exchange for turning in one fishpot made with small size mesh (one and a quarter inches in diameter or less), fishermen receive enough larger mesh size wire to make <u>two</u> new pots of equivalent size. This helps to offset the costs of new gear and the per pot decrease in catch biomass that will result from using larger mesh (Clark, 1991 (a)).

Initially, a multifaceted approach, combining printed materials, audiovisual presentations, and face-to-face interaction, is probably the best way to start an education programme. Depending on the target audience and budget, a variety of additional options can be employed: mass media (press, television, radio), fixed exhibits, tours, training workshops, the sale of promotional items such as T-shirts, and informal recreational activities with an educational focus. Evaluation and feedback mechanisms should be built into education programmes to allow for necessary modifications in approach (Clark, 1991 (a)).

10. REFERENCES [1]

Amarasinghe, S.R., H.J.M. Wickremeratne and G.K. Lowry, Jr. 1987. Coastal Zone Management in Sri Lanka 1978-1986. In: Coastal Zone '87, Amer.Soc. Civ.Eng., (3):2822-41

Ahmad Y.J. and G.R. Sammy. 1985. Guidelines to Environmental Impact Assessment in Developing Countries. Hodder and Stoughton, London. 52 p.

Beanlands, G.E. 1985. Basic approaches to EIA. In: Proceedings of the Caribbean Seminar on Environmental Impact Assessment. Caribbean Conservation Association. pp. 64-81

Berwick, N.L. and R. Chamberlain. (in press). Systems Analysis for Integrating Tropical Coastal Resources with Watershed Use. In: Proc. Fifth International Coral Reef Congress

Brown, L.R. et al., 1985. State of the World. W.W. Norton & Co., New York. 301 p.

Burbridge, P.R. 1986. The Importance of Multiple Use Management Strategies for the Sustainable Development of Coastal Resource Systems (unpublished manuscript). 14 p.

Burbridge, P.R. 1987. Economic Considerations in Management of Coastal Resources. In: CAMP Network Newsletter, May 1987. pp. 2-3

Burbridge, P.R. and Koesoebiono. 1981. Coastal Zone Management in Southeast Asia. In: Southeast Asia Seas: Frontiers for Development. McGraw-Hill. pp.110-35

Burbridge, P.R. and J.E. Maragos. 1985. Analysis of Environmenal Assessment and Coastal Resources Management Needs (Indonesia). Intl.Inst.for Environ. Develop., Washington, D.C. (Draft report)

Burbridge, P.R. and J.A. Stanturf. (in press). The Development and Management of Tidal Wetlands in Southeast Asia. Unesco, Paris

Caddy, J.F. 1990. Enclosed and semi-enclosed seas: principal issues and future actions. UN/FAO, Fishery Resources and Environment Division, Informal paper. 5p.

Cambers, G. 1987. Coastal zone management programmes in Barbados and Grenada. In: Coastal Zone '87, Proceedings of the Fifth Symposium on Coastal and Ocean Management, Vol.1:1384-94. New York American Society of Civil Engineers

---

[1] The references are presented as submitted by the author

CCD. 1988. Coastal Zone Management Plan. Sri Lanka Coast Conservation Dept. 110p.

Chua, T.E. 1986. Managing ASEAN coastal resources. Tropical Coastal Area Management, Vol.1, No.1 ICLARM, Manila. pp. 8-10

Chua, T.E. and A.T. White 1988. Policy Recommendations for Coastal Area Management in the ASEAN Region. Contrib. No.544, ICLARM, Manila. 10 p.

Chua, T.E. and J.R. Charles. 1984. Coastal Resources of East Coast Peninsular Malaysia. Penerbit Universiti Sains Malaysia. 306 p.

Clark, J.R. 1977. Coastal ecosystems management: A technical manual for the conservation of coastal zone resources. Wiley-Interscience, New York. 928p.

Clark, J.R. 1980. Progress in management of coastal ecosystems. Helgolander Meeresunters 33. pp. 721-31

Clark, J.R. 1985. Recommendations for a Combined Coastal Management and Protected Areas Program for the Saudi Arabia Red Sea Coast. Summary Report submitted to IUCN by the National Park Service (USA)

Clark, J.R., J.S. Banta and J.A. Zinn. 1980. Coastal Environmental Management. Fed.Ins.Admin. FLA-4. 161 p.

Clark, J.R. 1986. A Coastal Management Program for the Saudi Arabian Red Sea Coast. In: Coastal Zone '87 Amer. Soc.Civ.Eng., (2):1673-81

Clark, J.R. 1987. Combining hazards mitigation and resources management through coastal area planning. In: Proc. Int.Symp. on Post-Disaster Response and Mitigation of Future Losses. Am. Bar Assoc. (Comm. on Housing and Urban Development), Washington, D.C.

Clark, J.R. 1988. Rehabilitation of Coral Reefs: Report of a Science Workshop. Rosenstiel School of Marine and Atmospheric Science, Univ. of Miami. 26p.

Clark, J.R. 1991a. Carrying Capacity: Defining the Limits to Tourism. In M. Miller and J. Auyong (eds.) Proc. of the 1990 Congress on Coastal and Marine Tourism (Honolulu, Hawaii). Natl. Cstl. Resources Research Center, Newport, Oregon. pp.117-31

Clark, J.R. 1991b. Carrying Capacity: A Status Report on Marine and Coastal Parks and Reserves. Third International Seminar on Coastal and Marine Parks and Protected Areas. Florida, 11 May-5 June 1991

Clark, J.R., Ed., 1991c. The Status of Integrated Coastal Zone Management: A Global Assessment. CAMPNET, University of Miami/RSMAS, Miami, Florida. 118p.

Clark, J.R. (In press, a). Coastal Area Management and Planning: Strategic Planning and Program Development. Renewable Resources Information Series, Coastal Management Publication No. 4: USDI/NPS and USAID

Clark, J.R. (In press, b). Carrying Capacity and Tourism in Coastal and Marine Areas. Parks magazine. IUCN, Middlesex, U.K.

Cohen, F.G. 1985. Social Impact Assessment in the Context of Socio-cultural Change. In: Proc. of the Caribbean Seminar on Environmental Impact Assessment, Caribbean Conservation Association. pp.82-9

Dixon, J.A. 1989. Coastal resources:assessing alternatives. In T.E. Chua and D. Pauly (eds.) Coastal Area Management in Southeast Asia: Policies, management strategies and case studies. ICLARM conference Proceedings 19. pp. 153-62

Dunkel, D.R. 1984 "Tourism and the Environment: A Review of the Literature and Issues." Environmental Sociology, Number 37, Spring, 1984

ECLAC. 1985. Tourism and Environment in Caribbean Development with Emphasis on the Eastern Caribbean. Economic Commission for Latin America and the Caribbean, Subregional Headquarters for the Caribbean, United Nations Environment Programme

Gammon, J.K. and S.T. McCreary. 1988. Suggestions for Integrating EIA and Economic Development in the Caribbean Region. In: Environ. Impact Assess. Rev. Vol.8, Elsevier Sci. Publ. Co.

Geoghegan, T. 1984. Environmental Guidelines for Marine Development in the Lesser Antilles. Eastern Caribbean Natural Areas Management Program, St. Croix, USVI, 44 p.

Gritzner, J.A. 1986. National Research Council, Wash., D.C.: letter of 22 April

Hamilton, L. and S. Snedaker. 1984. Handbook for Mangrove Area Management. East/West Center, IUCN and Unesco (Paris). 123 p.

Hayes, M.O. 1985. Beach Erosion. In: J. Clark (ed.) Coastal Resources Management: Development Case Studies, Coastal Management Pub. No. 3, RPI and Natl. Park Service. pp. 67-200

Healy, R. G. and J.A. Zinn. 1985. Environment and Development Conflicts in Coastal Zone Management. J. Amer Planning Assn, Vol.51, No. 3. pp. 299-311

Heyman, A.M. 1986. Inventory of Caribbean Marine and Coastal Protected Areas. Organization of American States, Washington, D.C. 146 p.

Hildebrand, L. P. 1989. Canada's Experience with Coastal Zone Management. Oceans Inst of Canada (Halifax). 118 p.

Hodgson, G. and J.A. Dixon 1988. Logging Versus Fisheries and Tourism in Palawan. Occ. Paper No.7, East-West Environment and Policy Institute, Honolulu. 95p.

Holl, K., Daily, G., and Erlich, P.R., 1990. Integrated Pest Management in Latin America. Environ. Conserv., 17. pp 341-50

ICLARM. 1986. Tropical Coastal Area Management Newsletter, Vol. 1, No. 1. International Center for Living Aquatic Resources Management, Manila, Philippines

IUCN. 1990. Caring for the World. A Strategy for Sustainabilty. IUCN, Gland, Switzerland. Second Draft, June, 1990. 135 p.

Jernelov, A. and U. Marinov. 1990. An Approach to Environmental Impact Assessment for Projects Affecting the Marine Environment. UNEP, Regional Seas Repts and Studies, No. 122. 37 p. + App.

Johannes, R.E. 1982. Traditional Conservation Methods and Protected Marine Areas in Oceania. Ambio, (2) 5 p. 258-61

Joliffe, I.P. and C.R. Patman. 1985. The coastal zone: the challenge. J. Shoreline Mgmt. (1) 1. pp. 3-36

Knecht, R.W. 1979. Policy Issues for Coastal Area Development/Management: Legislation, Agencies, Programs. In: Proc. of the Workshop on Coastal Area Development and Management in Asia and the Pacific. pp. 119-127

Maragos, J.E., A. Soegiarto, E.D. Gomez and M.A. Dow. 1983. Development Planning for Tropical Coastal Ecosystems In: Natural Systems for Development, R.A. Carpenter (ed.), MacMillan, New York. pp. 229-98

Matuszeski, W.E., E. Perez and S. Olsen. 1988 Structure and Objectives of a Coastal Resources Management Program for Ecuador. URI/AID Tech. Rept., University of Rhode Island, Institute for Coastal Resources Management Project. 38 p.

McHarg, I. 1969. Design with Nature. The Natural History Press, Garden City, New York. 197 p.

MacLean, J.L. and L.B. Dixon. 1984. ICLARM Report 1983. International Center for Living Aquatic Resources Management, Manila, Philippines. 115 p.

McShine, H. 1985. The Status of Coastal Zone Management in Trinidad and Tobago. Unpublished paper prepared for the Workshop and Project Planning Meeting on Coastal Zone Management, 22-26 July 1985. (Castries, Saint Lucia). 25 p.

Murphy, P., ed., 1983. Tourism in Canada: Selected Issues and Options. Western Geographical Series, Vol. 21: pp. 3-23 p.

NAS. 1983. Quoted in National Audubon Society v. Superior Court (1983), 33 Cal. 3rd 419, pp. 433-4

NCDNR. 1986. Protecting Coastal Waters Through Local Planning. Div. Coastal Management, No. Carolina Dept. of Natural Resources and Community Development, Raleigh, N.C.

NEPC. 1983. National Environmental Enhancement Program. Natl.Environ.Prot.Council, Imelda Marcos, Chairperson. 137 p.

NOAA/CZM. 1980. Coastal Management Program for the Commonwealth of Puerto Rico. NOAA, Office of CZM, Washington, DC, 16

NPS. 1986. Position Paper on Coastal and Marine Parks and Protected Areas. Prepared by Participants of the International Seminar on Marine and Coastal Parks and Protected Areas (April '86). US National Park Service, Office of International Affairs, Washington DC, 12 p.

OAS. 1984. Integrated Regional Development Planning: Guidelines and Case Studies from OAS experience. Organization of American States, Washington, DC, 230 p.

O'Brien, R.J. 1988. Western Australia's Nonstatutory Approach to Coastal Zone Management: An Evaluation. Coastal Zone Management, (16) 3: pp. 201-14

OECD. 1990. Integrated coastal zone management and marine living resources. Organization for Economic Co-Operation and Development (Comm. on Fisheries), AGR/FI/ENV, 90 (1), Paris. 13 p.

Ogden, J.C. and E.H. Gladfelter (eds.) 1983. Coral Reefs, Seagrass Beds and Mangroves: Their Interaction in the Coastal Zones of the Caribbean. Unesco, Repts. in Mar.Sci. No. 23. 133 p.

Olsen, S. 1987. Sri Lanka completes its coastal zone management plan. CAMP Newsletter (Aug. 1987). p. 7.

Porter, M. 1987. The state of strategic thinking. The Economist, 23 May 1987. pp. 17-24

Renard, Y. 1986. Citizen Participation in Coastal Area Planning and Management. CAMP Newsletter, October 1986. National Park Service, Office of International Affairs, Wash., DC, pp. 1-3

Ruddle, K. and R.E. Johannes (eds.). 1985. The Traditional Knowledge and Management of Coastal Systems in Asia and the Pacific. Unesco (Jakarta). 313 p.

Sadler, B. 1988. Sustaining Tomorrow and Endless Summer: On Linking Tourism and Environment in the Caribbean. In: F. Edwards (ed.) Environmentally Sound Tourism in the Caribbean, University of Calgary Press, Calgary, Alberta, Canada

Saenger, P. 1989. Environmental Impacts of Coastal Tourism: An Overview and Guide to Relevant Literature. Informal paper, Centre for Coastal Mgmt., NSW, Australia. 17 p.

Saenger, P., E.J. Hegerd, and J.D.S. Davie. 1983. Global Status of Mangrove Ecosystems. Comm.Ecol.Paper No. 3, IUCN, Gland, Switzerland. 88 p.

Salm, R.V. and J.R. Clark. 1984. Marine and Coastal Protected Areas: A Guide for Planners and Managers. IUCN, Gland, Switzerland. 302 p.

Salm, R.V. 1986. Oman. Coastal Zone Management Plan: Greater Capital Area. IUCN, Gland, Switzerland. 78 p.

Salm, R.V. 1987. Coastal zone management in the Sultanate of Oman. CAMP Newsletter (Aug. 1987). National Park Service, Office of International Affairs, Washington DC, pp. 4-5

Smith, I. 1984. Social Feasibility of Coastal Aquaculture: Packaged Technology from Above or Participatory Rural Development? In: Consultation on Social Feasibility of Coastal Aquaculture (Bay of Bengal Programme, FAO), App.3. pp. 12-34

Snedaker, S.C. and C.D. Getter. 1985. Coastal Resources Management Guidelines. Coastal Management Publication No. 2, NPS/AID Series, Research Planning Institute, Columbia, S. Carolina. 205 p.

Snedaker, S.C., J.C. Dickinson III, M.S. Brown, and E.J. Lahmann. 1986. Shrimp Pond Siting and Management Alternatives in Mangrove Ecosystems in Ecuador. Report for USAID, Office of Science Advisor. 67 p.

Sorensen, J.C. and S.T. McCreary. 1990. Institutional Arrangements for Management of Coastal Resources. Coastal Management Publication No. 1, (Rev. ed.) U.S. Nat. Pk. Serv./USAID Series. 194 p.

SPREP. 1985. South Pacific Coastal Zone Management Program. Commonwealth Sci. Council and South Pac. Reg. Environ. Prog. 17 p.

Thompson, T.P. 1985. Appropriate Methodologies for the Identification of Environmental Impact and the Evaluation of Alternatives. Island Resources Foundation, Occ. Pap. No. 42. 24 p.

Tolentino, A.S. 1984. How to Protect Coastal and Marine Ecosystems: Lessons from the Philippines. In: National Parks, Conservation and Development. IUCN, Gland, Switzerland (eds. J.A. McNeeley and K.R. Miller). pp. 160-4

Towle, E.L. 1985. The Island Microcosm. In: J. Clark (ed.) Coastal Management Publication No. 3, NPS/AID Series, Research Planning Institute, Colombia, S. Carolina, 305 p.

UNEP. 1988. A Common Methodological Framework for Integrated Planning and Management in Mediterranean Coastal Areas. (draft) UNEP - PAP - 4/EM.5/2. 19 p. + App.

UNESC. 1987. Development of marine areas under national jurisdiction: problems and approaches in policy-making, planning and management. United Nations, New York. 22 p.

URI. 1986. The Management of Coastal Habitats in Sri Lanka. Report of Workshop, 12-15 May 1986. University of Rhode Island, Coastal Resources Center. 36p.

URI. 1989. Coastal Resources Management Project: Prospectus. University of Rhode Island/USAID. 38 p.

USAID. 1984. Project Identification Document: Coastal Resources Management Project. USAID/Bur. for Sci. and Tech., Washington, DC (primary author Randon DuBois).

White, A.T. 1987. Why Public Participation is Important for Marine Protected Areas. CAMPNET Newsletter, August 1987. National Park Service, Office of International Affairs, Wash., DC pp. 5-6

WRI. 1986. World Resources 1986. World Research Institute, Washington, DC 353 p.

Appendix 1

Roster of Integrated Coastal Area Management Programmes, Pilot Programmes and Feasibility Studies 1/

1. Existing national programmes:

Belize. National Coastal Management Program. 1991. Contact: Vincent Gillett, Fisheries Administration, Princess Margret Drive, P.O. Box 148. Belize City. Telephone: 501 2 44-552. Fax: 32-983.

Brazil. National Coastal Zone Management Plan*. Created by national law in 1988. Prepared by the Inter-ministerial Commission for the Resources of the Sea (CIRM) Contact: Renato Herz, Instit. Oceanografico, Univ. de São Paulo, Telephone: 55 11 813-3222. Fax: 210-3092.

British Virgin Islands. Coast Conservation and Development Program. Almost enacted into law in 1991. Contact: Gillian Cambers, Conservation and Fisheries Department, Government of the British Virgin Islands, Tortola, Telephone: 1 809 494-5682, Fax: 495-2100.

Brunei Darussalam. Integrated Coastal Management Plans. 1991. Contact: Haji Matdanan bin Haji Jaafar, Dept. of Fisheries. P.O. Box 2161, Bandar Seri Begawan 1921. Tel: 673 242-067. Fax: 069.

China. National Project of Comprehensive Investigation in the Mainland Coastal Zone. A national law is currently being drafted. Currently regulations are also being drafted for the provinces of Liaoning, Shangdong, Guangdong and Hainan as well as the city of Tianjin. Contact: Chen Degong, Institute for Marine Development Strategy. No 8. Dahuisi St., Haidian District, Beijing 100081. Telephone: 86 1 831-7542. Fax: 3612.

Costa Rica. The Planning and Management of the Marine and Terrestrial Zone*. Enacted by national law in 1977. Contact: Robert Chaverri, Sinergía 69, Apartado 672-2010 San Pedro, San Jose. Telephone: 506 532-766. Fax: same.

---

1. This material, generously provided by Dr Jens C. Sorensen, University of Rhode Island, is presented without modification. It appeared previously in the "Intercoast Network: International Newsletter of Coastal Management" (Coastal Resources Center, Univ. Rhode Island, Narragansett, R.I., 02882) in nearly this same form - main change is the addition of Brunei Darussalam.

2. An asterisk (*) indicates programmes being implemented.

Ecuador. National Coastal Management Program*. Enacted by executive decree in 1989. Contact: Miguel Fierro, Coastal Management Programs Office, Av. Quito y Padre Solano, Edificio del MAG, Piso 20, Casilla 5850, Guayaquil. Telephone: 593 4 284-453. Fax: 285-038.

France. Planning, Protection, and Development of Coastal Space*. Enacted by national law in 1986. Contact: Domininque Ligraim, Conservatoire Littoral, 72 Rue Regnault 75013 Paris. Telephone: 33 1 457-07475.

Israel. Master Plan for the Mediterranean Coast*. First phase enacted in 1981 by government regulation. Contact: Valyrie Brachya, Environmental Planning, Ministry of the Environment. Jerusalem, Israel. Telephone: 972 2 701-606. Fax: 385-038.

Japan. Tentative Guidelines for the Planning concerning the Comprehensive Utilization of the Coastal Zone. Government declaration in 1990 Contact: Yoshimi Nagao, Nihon University, 7-24-1, Narashinodai, Funabashi, 274 Japan. Telephone: 81 3 547-01919.

New Zealand. New Zealand Coastal Policy Statement. Enacted by the Resources Assessment Act of 1991. Contact: Hamish Rennie, Dept. of Conservation. P.O. Box 10420, Wellington. Telephone: 64 4 471-3066. Fax: 1082.

Oman. Coastal Zone Management Plan*. The first phase of planning was initiated in 1986. Contact: Ali Amer Al-Kiyumi. National Conservation Strategy, Ministry of Environment, P.O. Box 332, Muscat. Telephone: 968 696-458. Fax: 602-320.

Spain. A Program to Define Protect and Regulate the Use of the Shores*. Created by the Shores Act of 1988. Contact: Francisco Montoya, Ministry of Public Works and Urban Planning, Plaza Imperial, Tarraco #4, Tarragona 43071. Telephone: 34 77 216-613. Fax: 230-536.

Sri Lanka. National Coastal Zone Management Plan*. Adopted 1990 by Cabinet. Contact: B. Kahawita, Coast Conservation Department, Maligawatte Secretariat, Colombo, 10. Telephone: 94 1 588-311. Fax: 575-032.

Saint Kitts (Saint Christopher) - Nevis. South-East Peninsula Development and Land Use Management Plan*. Created by legislation in 1986. Contact: Patrick Williams, South-East Peninsula Development Authority, Government House, Saint Kitts. Telephone: 1 809 465-2277 Fax: 1106.

Thailand. National Coral Management Strategy*. Phuket Island Action Plan*. Action Plan for the Upper South Sub-region's Coastal Zone. 1991. Contact: A. Suphapodok. Office of the National Environment Board, 60/1 Soi Phibun Watthana 7, Rama VI Road, Bangkok, 10400. Telephone: 66 2 279-7180. Fax: 0672.

Turkey. Definition, Use and Planning of the Coastal Zones. Enacted by national law in 1990. Also pilot programs in Antalya Province. Contact: Semra Ongan, Resik Belender Sok 91-5, Cankaya, Ankara. Telephone: 90 4 141-0249.

United States. The National Coastal Zone Management Program*. Enacted by national law in 1972. The program currently includes the states of; Alabama, Alaska, California, Connecticut, Delaware, Florida, Hawaii, Louisiana, Maine, Maryland, Michigan, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Oregon, Rhode Island, South Carolina, Virginia, Washington, Wisconsin. Contact: Trudy Coxe, Office of Ocean and Coastal Resource Management, NOAA, 1825 Connecticut Ave. NW, Washington, D.C. 20235. Telephone: 1 202 606-4111. Fax: 4329. Also The National Estuary Program. The following estuary systems are each in the process of preparing or implementing a Comprehensive Conservation and Management Plan; Albermarle/ Pamlico Sounds (North Carolina), Barataria and Terrebonne Bays (Louisiana), Buzzards Bay (Massachusetts), Casco Bay (Maine), Delaware Bay (Delaware and New Jersey), Delaware Inland Bays (Delaware), Galveston Bay (Texas), Indian River Lagoon (Florida), Long Island Sound (New York and Connecticut), Massachusetts Bay, Narragansett Bay (Rhode Island), New York/New Jersey Harbour, Puget Sound (Washington State), San Francisco Bay (California), Santa Monica Bay (California), Sarasota Bay (Florida), Tampa Bay (Florida). Contact: Robert Wayland, Wetlands, Oceans and Watersheds Office, U.S. Environmental Protection Agency, 401 M Street NW, Washington 20460. Telephone: 1 202 260-7166. Fax: 6294.

2. Existing state/provincial or regional programmes:

American Samoa. Coastal Zone Management Program*. Approved in 1980. Contact: Lelei Peau, Development Planning Office, Government of American Samoa, Pago Pago, 96799. Telephone: 684 633-5155. Fax: 4195.

Fraser River Estuary (Canada). Fraser River Estuary Management Program*. Created by agreement between the Province of British Columbia and the federal government in 1985. Contact: Mike McPhee, F.R.E.M.P, 708 Clarkson St., New Westminster, B.C. V3M 1E2. Telephone: 604 525-1047. Fax: 3005.

Great Barrier Reef (Australia). The Great Barrier Reef Marine Park*. Enacted by national legislation in 1975. Contact: Graeme Kelleher, Great Barrier Reef Marine Park Authority, GPO Box 791 Canberra, ACT. Telephone: 61 62 47-0211. Fax: 5761.

Guam. Coastal Zone Management Program. Approved in 1979. Contact: Peter Leon Guerrero, Bureau of Planning, Government of Guam, P.O. Box 2950, Agana 96910. Telephone: 671 472-4201. Fax: 477-1812.

Isla de Margarita (State of Nueva Esparta, Venezuela). Coastal Planning Arrangement for the Region*. Created by presidential decree in 1987. Contact: Ernesto Díaz, Ministry of Natural and Renewable Resources. Torre Sur, Piso 18, Centro Simón Bolívar A.A. 6623, Caracas 1010-A. Telephone: 58 2 408-1230. Fax: 483-2445.

Jiangsu Province (China). Regulation on Coastal Zone Management in Jiangsu Province. Provincial law enacted in 1991. Contact: Chen Degong (see listing for China above).

Kosrae State (Federated States of Micronesia). Kosrae Island Natural Resources Management Plan. 1989. Lou Brooks, Department of Conservation, P.O. Box CD, Kosrae State 96944. Telephone: 691 370-3044. Fax: 2066.

Laguna de Terminos (Campeche State, Mexico). Management Plan for the Laguna de Terminos System. Planning program initiated in 1990. Contact: Alejandro Yáñez-Arancibia, Programa EPOMEX, Universidad de Campeche, Apartado Postal, 520, Campeche 24030. Telephone: 52 981 11600. Fax: 65954.

New South Wales, State (Australia). New South Wales Coastal Policy. 1990. The Coastal Committee of New South Wales. Contact: Bruce Thom, Research, Main Quadrangle, Sydney University, NSW 2006. Telephone: 61 2 692 2273. Fax: 3636.

Northern Marianas (USA). Coastal Resources Management Program*. Approved in 1980. Contact: Joaquin Villagomez, CRM Office, Nauru Building, Saipan 96950. Telephone: 670 234-6623. Fax: 0007.

Pohnpei State (Federated States of Micronesia). Pohnpei Island Natural Resources: Proposed Management Plan. 1987. Contact: Director, Conservation and Natural Resources Surveillance, Kolonia 96941. Telephone: 691 320-2735. Fax: 2331.

Puerto Rico. (USA). Coastal Zone Management Program*. Approved 1978. Contact: Ines Monefeldt, Coastal Management Office, P.O. Box 5887, Puerta de Tierra 00906. Telephone: 1 809 724-5516. Fax: 722-2785.

San Francisco Bay (California). San Francisco Bay Plan*. Enacted by California state legislation in 1965. Contact: Alan Pendleton, S.F.B.C.D.C., 30 Van Ness Ave., Room 2011, San Francisco, 94102. Telephone: 1 415 557-3686. Fax: 3767.

Sian Ká an (State of Quintana Roo, Mexico). Management Program for the Biosphere Reserve*. Created by presidential decree in 1986. Contact: Sebastian Estrella Pool, Dirección General de Parques, Reservas y Areas Protegidas, SEDUE, Rio Elbe #20, District Federal 06500. Telephone: 52 5 286-6231.

Venice Lagoon (Italy). The Comprehensive Management of the Venice Lagoon Ecosystem*. Contact: Francesco Bandarin, Consorzio Venezia Nuova, San Marco 2803, Venice. Telephone: 39 41 52-93-511. Fax: 89-252.

Virgin Islands (USA). Coastal Zone Management Program*. Approved in 1979. Contact: Joan Harrigan-Farrelly, Department of Planning and Natural Resources, Nisky Center, Suite 231, No. 45A Estate Nisky, Charlotte Amalie, St. Thomas 00802. Telephone: 1 809 774-3320. Fax: 5706. Also: Biosphere Reserve Program for St. John Island. Contact: Mark Koenigs, Virgin Islands National Park, St. John V.I. 00831. Telephone: 1 809 776-6201. Fax: 4714.

Wadden Sea (the Netherlands' component). The Dutch Wadden Sea Management Plan*. Enacted by national legislation in 1981. Contact: Norbert Dankers, Research Inst. for Nature, Postbus 167, 1790 AD Den Burg. Telephone: 31 2220- 69-700. Fax: 19-235.

Western Australia State. Coastal Planning and Management in Western Australia. A Government Position Paper. 1983. Coastal Management Coordination Committee was formed in 1982. Contact: Ian Eliot, Coastal Management and Co-ordinating Committee, Albert Facey House, 469 Wellington St., Perth 6000 W.A. Telephone: 61 9 264-7777. Fax: 321-1617.

Yap State (Federated States of Micronesia). Yap Island Marine and Coastal Resources Management Plan, Draft. 1991. Marine Resources Division. Contact John Iou, Marine Resources Division, P.O. 251, Colonia. Telephone: 691 350 2294. Fax: 4113.

3. National, state/provincial or regional pilot programmes or feasibility studies:

Australia. Resource Assessment Commission Coastal Zone Inquiry and Commonwealth Policy Working Group. In the past 25 years there have been 25 reports in respect to coastal zone management the latest was, The Injured Coastline; Protection of the Coastal Environment. Report to the House of Representatives. 1991. Contact: Richard Kenchington, Resource Assessment Commission, Canberra. Telephone: 61 6 271-5280. Fax: 5073.

Bangladesh. The feasibility study on the preparation of an Integrated Coastal Area Management Program. 1991. Contact: Zaman Mozumder, Planning Commission, Shere Bangla, Nagar, Dhaka. Telephone: 880 2 314-724.

Buenos Aires Province (Argentina). Surveys of the Interdisciplinary Commission for the Management of the Coastal Zone. 1985-1988. Contact: Aldo Brandani, 4834 El Salvador, 1414 Buenos Aires. Telephone: 54 1 727-061. Fax 313-7267.

Canada. Atlantic Coastal Action Program. Thirteen demonstration projects in the four maritime provinces (New Brunswick, New Foundland and Labrador, Nova Scotia, and Prince Edward Island). Created as a component of the National Green Plan in 1991. Contact: Larry Hildebrand, Environment Canada, 4th floor, 45 Alderney Drive, Dartmouth, Nova Scotia. Telephone: 1 902 426-9632. Fax: 2690.

Colombia. The Development and Administration of the Colombian Coastal Zone in the Caribbean Sea. 1984. Produced by the Centro de Investigaciones Oceangráficas e Hidrográficas. Contact: Rafael Steer, Comisión de Oceanografía, Apartado Aereo 28466, Bogotá. Telephone: 57 1 222-0449. Fax: 0416.

El Salvador. The Environmental Protection Project of El Salvador; South Central Coast Component (PROMESA). Initiated by presidential decree in 1991. Contact: The Executive Secretary, SEMA of CONAMA, Ministry of Agriculture, 83 Avenida Norte y 11 Calle Poniente #704, Escalaon, El Salvador. Telephone: 503 791-579. Fax: 242-944.

Honduras. Environmental Plan for the Tourism Development of Islas de Bahias. Established in 1991 by presidential decree. Contact: Nico Agurcia, Comisión pro Desarrollo Turístico de Las Islas Bahías, Tegucigalpa. Telephone: 504 32-7376. Fax: 7362.

Island of Rhodes. (Greece). Coastal Area Management Programme for the Island of Rhodes. Established in 1988 in conjunction with the Priority Actions Programme of the UNEP's Mediterranean Action Plan. Contact: Dimitrios Tsotsos, PERPA, Ministry of the Environment, Physical Planning and Public Works, Patission 147, Athens. Telephone: 30 1 865-0106. Fax: 864-7420.

Indonesia. Integrated Management Plan for Segara Anakan-Cilacap, Central Java. 1991. Also Action Plan for the Sustainable Development of Indonesia's Marine and Coastal Resources. 1988. Contact: Sukotjo Adisukresno, Directorate General of Fisheries. 6th Floor B Building, Ministry of Agriculture, Jalan Harsono RM No 3, Ragunan-Pasar Mingu, Jakarta Selatan. Telephone: 62 21 790-4026. Fax: 80-3196.

Izmir Bay (Turkey). Coastal Management Programme for the Bay of Izmir. Established in 1988 in conjunction with the Priority Actions Programme of UNEP's Mediterranean Action Plan. Contact: (Ms) Nuran Talu, Undersecretariat of the Environment, Ataturk Bulvari 143, Ankara. Telephone: 90 41 174-455. Fax: 117-7971.

Kastela Bay (Croatia, Yugoslavia). Coastal Management Programme for the Bay of Kastela. Established in 1988 in conjunction with the Priority Actions Programme of the UNEP's Mediterranean Action Plan. Contact: Ivica Trumbic, Priority Actions Programme Regional Activity Centre, UNEP, Kraj. sv. Ivana 11, 58000 Split, Croatia. Telephone: 38 58 43-499. Fax: 361-677.

Malaysia. South Johore Coastal Resources Plan. 1991. Contact: Ching Kim Looi, ASEAN Secretariat for COST, Ministry of of Science, Technology and the Environment. 14th Floor Wisma Sims Darby, Jalan Raja Laut, 50662, Kuala Lumpur. Telephone: 60 3 293-8955. Fax: 6006.

Maldives. Report on the Mission to the Republic of Maldives in Respect to Coastal Management. 1985. Contact: Alex Dawson Shepard, Ministry of Planning, Ghaz Building 2005, Male. Telephone: 960 324-861. Fax: 327-351.

Northern Territory (Australia). Northern Territory Coastal Management. 1982. Contact: Janice Warren, Coastal Management Committee, Conservation Commission, P.O Box 496, Palmerston 0831, NT. Telephone: 61 89 894-469. Fax: 657.

Philippines. Integrated Coastal Management Plan for Lingayen Gulf. Contact: Leonardo Quitos, NEDA- Region 1, Don Pedro Building, Pagdaraoan, San Fernando, La Union. Telephone: 63 2 412-679. Fax: 413-066.

Prince Edward Island, Province (Canada). Coastal Zone Planning Initiative. Initiated by a Memorandum of Understanding on Conservation and Development between the Province and the federal government in 1987. Contact: Christopher Leach, Dept. of Community and Cultural Affairs, P.O. Box 2000, Charlottetown, P.E.I. CIA 7N8. Telephone: 902 368-4882. Fax: 5544.

Queensland, State (Australia). Coastal Protection Strategy: Green Paper. Proposal for Managing Queenslands Coast. Promulgated in 1991 for review and comment. Contact: Chris Pattearson. Division of Coastal Protection, P.O. Box 155, North Quay, 4002 Queensland. Telephone: 61 7 227-7111. Fax:

Ria de Aveiro (Portugal). Natural Resource Management Plan for the Estuary of the Aveiro River. Interdisciplinary and intergovernmental study group created in 1988. Contact: Carlos Borrego, Gabinete da Ria de Aveiro, Univ. de Aveiro, Rua San Jose, Rabumba, No. 3, 3800 Aveiro. Telephone: 351 34 25085.

Saudi Arabia. An Assessment of Management for the Saudi Arabian Red Sea Coastal Zone. 1987 Contact: Khaled Ibraheem Al Mubarek, Ministry of Agriculture and Water, Riyadh 11195. Telephone: 966 1 402-0268. Fax: same.

Singapore. Strategies for Urban Coastal Area Management. 1991. Contact: Chia Lin Sien, Dept. of Geography, National University of Singapore, 10 Kent Ridge Crescent, Singapore 05111. Telephone: 65 775-6666. Fax: 777-3091.

South Africa. A Policy for Coastal Zone Managment in the Republic of South Africa. 1989. Also Coastal Action Strategy (COAST) 1991. Contact: Bruce Glavovic. Department of Environment Affairs, Bag X2, Roggebay 0012. Telephone: 27 21 403-3035. Fax: 252-920.

Syria. Coastal Area Management Programme for the Syrian Coastal Region. Established in 1988 in conjunction with the Priority Actions Programme of UNEP's Mediterranean Action Plan. Contact: Yahia Owidah, General Commission for Environmental Affairs, Tolyani St., Damascus. Telephone: 963 11 215-426. Telex: 412-686 ENV SY.

Taiwan. Coastal Protection Plan. 1984. Adopted by executive authority. Also the Ministry of Interior in co-operation with other units of government is drafting a coastal zone management law. Contact: Dah-Win Sheih, Department of Fisheries, 37 Nan Hai Road, Taipei 100. Telephone: 886 2 312 4601. Fax: 331 6408.

Tasmania State (Australia). Footprints in the Sand; A Proposal and Discussion Paper on Coastal Zone Management Strategies. 1991. Contact: Geoff Tregenza, Coastal Project Team, Department of Environment and Planning, Box 510E, GPO Hobart 7001, Tasmania. Telephone: 61 2 306-737. Fax: 348-730.

Turks and Caicos. (British West Indies). Ecological Survey and Environmental Policies for the National Physical Development Plan. 1990. Contact: Oswald Williams, Dept. of Planning, Heritage and Parks, Grand Turk Island. Telephone: 1 809 946-2220. Fax: 2448.

United Kingdom. A Future for the Coast? Proposals for a U.K. Coastal Zone Management Plan. 1990. Contact: Susan Gubbay, Marine Conservation Society. 9 Gloucester Road, Ross-on-Wye, HR9 5BU. Telephone: 44 989 66-017. Fax: 68-715.

Victoria, State (Australia). Coastal Policy for Victoria. 1988. Contact: Chris Lester, Coastal Management and Coordination Committee. Department of Conservation and Environment. 7th Floor, P.O Box 41, East Melbourne 3002, Victoria. Telephone: 61 3 412-4987. Fax: 4160.

ISBN 92-5-103275-0 ISSN 0429-9345

9 789251 032756

M-43 T0708E/1/12.92/2200